THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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INTERNATIONAL SPECIFICATIONS.

THE inherent difference in the treatment, from the point of view of unification, of such things as steel girders, rails, rolling stock, cement, &c., and of those which may be properly said to come under the heading of electrical machinery and apparatus, is not always as fully appreciated as it might be.

In regard to the former, it will be noticed that in the majority of cases concrete figures, chemical analysis, and even actual designs, have been agreed upon between buyer and seller, as representing the best up-to-date practice, and it is undeniable that manufacturers have thereby reaped much benefit, through the lowering of the cost of production; on the other hand, combinations upon these lines, if carried too far into detail, may develop into trusts which tend to rob the consumer of the benefits which healthy competition brings, even if prices are not raised.

In regard to the latter, generally speaking, unification is brought about through agreement as to the tests which a machine or apparatus intended for any particular purpose shall fulfil; that is to say, in matters electrical unification is usually based on results, and not upon the means by which those results are obtained. On this principle neither dimensions nor design are touched upon, and whilst on the one hand a real basis of comparison is established, on the other hand invention and progress are in no way hampered, and commercial enterprise has free scope for development.

The difficulties surrounding international agreement as to engineering specifications generally, may, to a large extent, be traced to these fundamental differences; yet international co-operation in engineering affairs is certainly coming to the front more and more, and, in spite of many obstacles, is succeeding. It is, however, one thing to attempt, internationally, to draw up a specification for steel, and a very different problem to agree internationally upon the rating and tests for electrical machinery.

In the case of steel, the very fact that the question of chemical analysis must form the basis of any specification shows that the whole subject bristles with commercial difficulties and rivalries.

Manufacturers, as well as users, however, can only welcome the establishment of international rules for guidance in specifying electrical machinery, and many are the difficulties and annoyances, from the point of view of foreign trade, which will undoubtedly be obviated when such rules are promulgated by a recognised authority.

In its early stages it appeared to some that the Electrotechnical Commission was not likely to prove of much utility or even practical interest to the electrical industry as a whole. Its programme of work, including, as it then did, only symbols and nomenclature, seemed somewhat too far removed from the domain of practical politics and its organisation too cumbersome to effect much solid achievement.

The report, however, which we publish elsewhere in this issue, will show that the formation of the small International Committees has had the fortunate effect of overcoming this initial inertia, and from what we have been able to gather, the work of the Zürich meetings, when printed and issued by the Central Office, should prove of more than ordinary interest. From the British point of view, it is particularly gratifying to see that the B.E.A.M.A. was officially represented; the spirit of intimate co-operation displayed by the various bodies interested should certainly result in work of much practical utility. When, therefore, this first chapter, as we may be permitted to call it, is ratified at Berlin next autumn, it is to be hoped that it will be widely disseminated, and at a very moderate charge.

If the recommendations are added to year by year, and, by periodical revision, kept abreast of progress, the time and money expended will have been well justified.

APPRENTICESHIP SYSTEMS.

The *personnel* of a works is of a scarcely less importance to its success than the quality of the plant and machinery; and a great steel maker once gave it as his conviction that a fire which should destroy his works would be preferable to the loss of the services of his trained staff. The one may be rebuilt and equipped with equal or better machinery than before, but the *personnel* of the other can never be the same, and it may take years to train men up to fill satisfactorily all the old positions.

Works, like individuals, cannot stand still, they must either develop or decline, so that in every well-organised establishment there must be a continuous system of training recruits to fill new positions of responsibility rendered necessary by the natural expansion of the business, or to fill vacancies due to resignations, death or other cause.

This system of training in engineering works is known generally as the apprenticeship system, a system which has had to be considerably modified in recent years to meet the changes which in workshop practice have been brought about by the ever-increasing use of labour-saving tools.

In the days preceding the machine-tool era, when handicraft and manual dexterity were of prime importance, the apprentice system had become regularised, and a youth could enter a works with the certain knowledge that he would at least have an opportunity of becoming a skilled artisan in a definite or specific trade, and he might reasonably expect to have in due course a general knowledge of the details and construction of the machines manufactured. He would be able to make practically every part and to assemble and fit them together and set the machine to work.

Nowadays, a boy may be set to watch or mind a machine while it repeats day in and day out, with monotonous regularity and precision, a stereotyped operation; his foreman will keep him at this occupation as long as he will stand it, and when he at length gets a change, it will be to watch another machine go through another set of mechanical operations.

The problem of recasting the apprenticeship system in a form suitable to modern workshop conditions has been attacked both by educationists and by engineering employers, but whilst many suggestions have been made, no regularised or standard system has been evolved, and it is at present left to individual employers to work out their own schemes in detail to suit the conditions existing in their particular works.

In general, however, the new apprenticeship embraces not only the service of a specified number of years in a workshop, but also the attendance at day or evening classes in a technical school. We have from time to time given in our columns details of the conditions of apprenticeship adopted by various engineering firms, and we give below the chief points from a notice recently issued by Messrs. Mather and Platt, Ltd., of Manchester, regarding apprentices. Three classes of apprentices are taken, viz.:—

Class 1.—This class consists of boys of not less than 15 years of age, who desire to become artisans or "tradesmen" on reaching the age of 21. They must produce proofs of having had a satisfactory elementary education, and have passed Standard VI. They must attend evening classes at the Manchester or Salford Schools of Technology, or other approved schools. In some cases those who can show that they will derive full benefit therefrom, may be granted the privilege of attending the special day courses for apprentice engineers at the Manchester School of Technology, no deduction being made from their wages for the time so spent.

Class 2 consists of a limited number of youths not under 17 years of age, who can give proof, by examination or certificate, of having had a good general education at a secondary or public school; those who have had a recognised course of technical training, or have obtained distinction at a public school. A knowledge of French, German, or other modern language, is considered an additional qualification. This class is for youths who desire a practical training in different branches of engineering, and they are transferred from department to department as circumstances permit, so as to obtain as wide an experience as possible. The departments included in the curriculum are: the foundry, machine tools, fitting and assembling, and either the test room or drawing office. A probationary period of six months without wages must first be passed through, after which apprentices in this class receive 10s. a week up to the end of their apprenticeship. All second-class apprentices must continue their technical education at an approved technical school, or at the University, and as in the case of Class 1 the special day classes for apprentices may be attended if permission be obtained from the works manager.

Class 3 is for young men of not less than 20 years of age who desire to acquire a practical workshop training. They must have passed through a complete course of technical training or obtained an engineering or science degree at a University. Admittance to this class depends upon the educational qualifications a candidate is able to submit, and great importance is attached to a thorough knowledge of modern languages. A probationary period of six months without wages is necessary, at the end of which there is no obligation on the part of either probationer or firm to continue the employment. If, however, it is continued, a written agreement is entered into for a definite period, and although the firm cannot undertake that men in this class shall spend a specific time in any particular department, the management will, as far as possible, select such departments as shall be most suitable to the attainments and capabilities of each man.

General.—No entrance fee or premium is charged, nor is any apprentice indentured, nor is there any obligation to continue the employment of any apprentice.

Shop hours must be kept, and the usual works regulations observed by all classes.

A Visit to Paris.

Readers who are members of the I.E.E. will be interested to learn that the Société Internationale des Electriciens has invited the Institution to Paris for a few days in May next. During recent years great developments have taken place in the electrical world of Paris; railways have been electrified, new electric railways have been built, large power stations have been erected—there is much to see, of the greatest electrical interest, and we are sure that those who take part in the visit will have a thoroughly good time.

Artificers in the Royal Navy.

A remarkable pamphlet, accompanied by a letter from the secretary, has recently been sent to us from Devonport by the Royal Naval Artificer-Engineers' and Engine-Room Artificers' Benevolent Fund, in regard to which it is necessary to have reluctantly to confess that, although we have always listened attentively and sympathetically to any supported expressions of opinion of men within the Service touching matters of importance to the efficiency and well-being of the engineer branch, the statements put forward in the present instance seem to call for other treatment, as they are singularly lacking in force and justification. It has to be explained that this communication has little, if anything, in common with the old trouble concerning engineer officers. It is a plea put forward by certain discontented chief and engine-room artificers, entered at full age as fully qualified engineering mechanics, chief and artificer engineers promoted from chief and engine-room artificers, and a few engineer-lieutenants promoted from chief artificer engineers. Under existing conditions, the Navy is, in effect, a secret service, and it is impossible to determine the merits of an alleged grievance of this kind by direct question and answer. All that can be done is to examine the scanty information available, and to endeavour to test whether it is in agreement with such facts as have been published officially regarding the organisation of the Navy. The demand made is for increase in pay, increase in pension, openings to rise to the higher ranks in the engineering branch of the service, the opening of the Royal Naval Reserve to members of the corps of royal naval artificer engineers and engine-room artificers, and the retention by them of the engine-room watch keeping. As abstract propositions these are all legitimate, and, if made to the proper authorities, they would, no doubt, receive careful consideration; but the attempt to force them upon the public, through the Press, upon the questionable grounds stated in the above-mentioned letter and pamphlet, must entirely alienate the grumblers from the sympathy of those who have more than a superficial knowledge of service matters, and, incidentally, of those who have the best interests of the corps at heart. It may be asked: Then why take any notice of such statements? The answer is that—in justice to the great body of artificer engineers—it is desirable that the public should have the means of checking the statements of a misguided few.

The letter declares that "we are rapidly drifting towards the serious position of a steam Navy minus engineer officers." It states, moreover, that it is notoriously difficult to get candidates to enter for the engineer branch at all. It suggests also that for five years not a single engineer officer will have been added to the Royal Navy. These loose and inaccurate statements are made the lever for a demand of 7s. a day as starting pay for the Corps, and a minimum pension of £100 a year for chief artificer engineers. The argument is based upon the fact that Keyham College was closed in 1910, and that the first batch of the new engineer officers, under the new scheme of education and training for naval officers, cannot have specialised until the end of 1915. Nevertheless, anyone who cares to consult a *Navy List* will see that there is not likely to be a disappearance of engineer officers in 1915, and although there must necessarily be questions arising for adjustment between the old and the new schemes of entry, it is an entire misrepresentation to ask the public to believe that we are drifting towards the position of a steam Navy without engineer officers. There will be similar matters for adjustment in regard to new-scheme officers for the navigating, torpedo, gunnery and Royal Marine branches; and are we to be told that these branches will also be depleted until the end of the first term of specialisation in each branch? Again, the suggestion that it is notoriously difficult to get new-scheme candidates to enter for the engineer branch is difficult to reconcile with the assertion that the first batch of the new engineer officers "cannot have specialised until the end of 1915," for how is it possible, early in 1913, to contend that there is difficulty in getting them to enter, say, a year hence? The contingency has not yet arisen, and is not likely to arise.

It is most unfortunate that the question of linking-up the artificers with the commissioned ranks of the Engineer Branch of the Navy should have been put forward in this misleading manner, for we are firmly of opinion that, in the future, that branch will be greatly strengthened by a healthy system of promotion of men of ability from the lower deck. It is scarcely practicable to carry out such a reform in a hurry, and it must necessarily take effect upon those who have entered the service as boys and youths, rather than upon those who have entered later in life from a variety of mechanical trades, some of which are only remotely concerned with naval engineering. Again, it is difficult to see how those who are promoted can hope to qualify for the higher commissioned ranks; for the standard of education and training required for commanders, captains and admirals tends ever to become more exacting. The way may, nevertheless, be left open, so that those who can climb may climb. The general course of events will probably be that, instead of adding greatly to the accommodation at Dartmouth College to meet the future demands of the technical branches of the Navy in respect of watch-keeping lieutenants, the lower commissioned ranks will, of an increasing extent, be replenished from among the most deserving of the warrant officers, and the result will be to the advantage of the whole service.

Storage in Electricity Supply.

The important paper read by Mr. Whysall before the I.E.E. last month brings the question of storage on the large scale prominently forward once more. Our readers will recollect that in 1908 Mr. A. M. Taylor dealt with the subject very fully at the I.M.E.A. convention, and advocated the installation of very large batteries on the grounds of reliability and, above all, economy, bringing forward very cogent arguments in support of his views. On that occasion we expressed our cordial agreement with the author, having maintained for many years that engineers responsible for the design of central stations showed a regrettable lack of appreciation of the important advantages to be gained by the use of *adequate* storage—not the half-hearted, hesitating installation of a battery having an output of, say, 10 per cent. of that of the generating plant, though that at least ensured the maintenance of the station lighting and the excitation of the generators in time of emergency, but really *adequate* storage. What we mean by this may be exemplified by the policy of the four American undertakings cited by Mr. Taylor, which, even in 1908, possessed storage batteries of more than 130,000 kw. output, at the one-hour rate. The present paper, giving the actual results obtained with a big battery, and showing an important saving even when Mr. Pearce, to avoid undue optimism, discounted the results to the utmost possible extent, will arouse renewed interest in the matter, and encourage those who are considering the advisability of providing storage on a large scale.

We are impelled to enlarge upon this topic by the fact that during the past year there has been a deplorably large number of total or partial shut-downs of electricity works, and we are anxious to invert the order of the two qualifications of the storage battery to which we have referred. We want to urge station engineers to put down large batteries on the grounds of economy, and, *above all, reliability*. There is a grave risk that electricity supply will get a bad name for its lack of reliability unless station engineers not only *talk* about the extreme importance of reliability, as they often do, but also *do* something towards ensuring its achievement. Our rivals the gas suppliers are doing all they can to stem the tide of electricity supply, and they make the greatest possible use of every reported breakdown to back up their arguments.

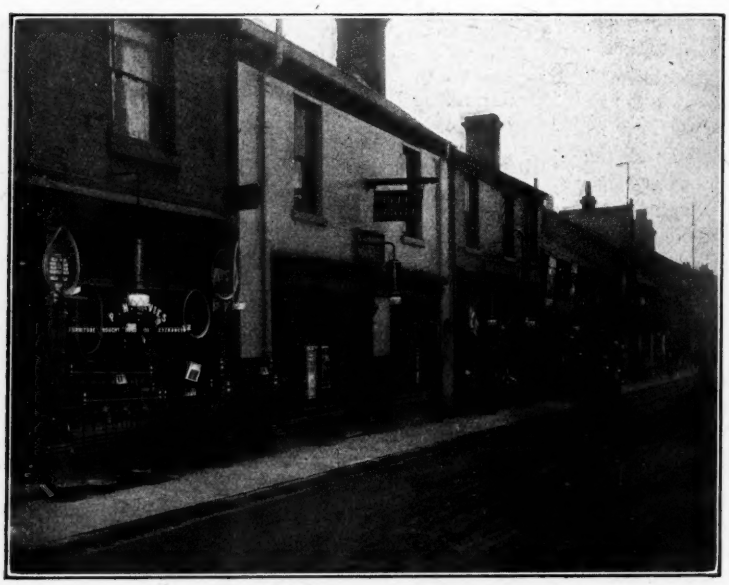
The fact that important economies can be effected with storage batteries ought alone to suffice to ensure their adoption; the reliability thus obtained should be a still more potent argument, and when these two considerations are combined the case is irresistible.

ARC LAMPS FOR THE OUTSIDE LIGHTING OF SHOPS, &c.

By W. FENNELL, A.M.I.E.E.

The situation at Wednesbury six months ago with regard to the outside lighting of shop premises was as follows :—

From its commencement about seven years ago the electricity undertaking had been making very good headway, and in the centre of the town, at least, the majority of the business premises used electricity extensively, and in many cases there were outside arc lamps. These lamps were such as might be usually met with in a medium-sized town—chiefly enclosed lamps in pairs across 230-volt mains. Two adjoining shopkeepers had combined to run a series of 5 flame arcs, using metal-cored carbons, and there was one large consumer with a similar series ; but, generally speaking, two enclosed lamps in series were usual, the shops not being large enough to justify the expense of a series of four or five low-voltage flame lamps. There were the usual complaints of burnt carbon holders, broken globes, badly adjusted lamps, and other troubles incidental to arc lighting, but still one could feel satisfied that electricity had practically outclassed gas, until high-pressure gas appeared. News was received one day that a notice had been deposited with the surveyor to open the roadway to lay a high-pressure gas main in the Market Place, and the next day it was stated that one of the largest users of arc lamps had signed an agreement to take the new gas supply, and that negotiations were in an advanced state with others to change over from electricity to high-pressure gas.



Outside Arc Lamps in a side Street, Wednesbury.

On making a visit to a large town a few miles off, it was obvious that these same high-pressure gas lamps had swept the principal shopping streets of arc lamps within a few months. One was astonished at the swiftness of the change, and felt it would be disastrous if such a thing happened in Wednesbury. An inquiry as to the terms and conditions revealed the cause of the stampede. The gas authorities were offering to fix and maintain a 1,000-c.p. high-pressure lamp at £5 per annum, such lamp to be used during ordinary business lighting hours. Consumers were attracted by the low charge, and by the assurance of its being the first and last expense. Shopkeepers and their assistants hated messing with carbons and gas mantles. It had already been proved that they would not pay an extra for skilled attendance, and they grudged the expense of flame carbons. Again, and this is the most important point in a small town, shopkeepers did not want four or five lamps each, and two enclosed lamps cost more to run and gave less light than two high-pressure gas lamps. The various metal-filament lanterns were also out of the question ; they cannot compare with high-pressure gas.

The writer decided that the only way to meet this competition was immediately to offer a better light on the same terms. Not a very startling or original proposition ; but it involves many side issues, some of which are important, and require courage to force through. A recommendation was made to the Committee to carry out the following scheme, which was adopted, and which is probably the first of its kind :—

Consumers were offered a 7-ampere flame arc lamp, giving about 1,500 c.p., at £5 per lamp per annum, including hire, trimming, cleaning and current. All the facilities given by the gas authorities were provided at the same price, and, in addition, more light.

In order to give this supply, a low-pressure 50-volt three-wire main would be run in the principal shopping centre, so that any consumer could have one, two, or more lamps. This circuit was to be supplied by a motor-generator, the generator being fitted with balancing slip rings and transformers.

The works are in this case very close to the centre of the town, so the machine is at the works, but it could be placed in a basement, or, indeed, in a balancing station if required.

In order at once to demonstrate the advantages of the proposal, temporary overhead mains were run and connected to some of the battery regulators, and two sample lamps, one with yellow and the other with white carbons, were exhibited. These lamps were fixed on shops adjoining the one which had deserted to the "enemy," and were lighted on the opening day of the high-pressure gas supply. A circular was issued calling attention to the demonstration and stating the competing terms.

The proceedings were hardly dignified, but the result was magical. The gas authorities have not secured a second consumer for their high-pressure gas up to the present. The circular caused several who had intended to use high-pressure gas to draw back, and applications were received from consumers quite away from the high-pressure gas area. It was originally proposed to confine this special main to the area served by the high-pressure gas main, but it has already extended rapidly. In the six months which have elapsed, over 40 lamps have been connected, most of them new business, *i.e.*, they have replaced gas lanterns, or there had been no outside lighting, and there are several consumers with single arc lamps, some of them quite small shops. It is curious to note that those consumers who had series flame lamps have not changed over to the new circuit, although they were on the point of going in for gas six months ago. These are the occupiers of larger premises, of course, but there is no doubt they would have "deserted" if high-pressure gas light had made headway as in neighbouring towns.

In the first place, it was not claimed that the scheme would be very profitable—it was put forward as a necessary measure to retain the advertisement of outside lighting. The gas authorities were prepared to lose money on high-pressure gas, just as they are on street lighting. To be able to say that "So and so" has gone back to gas, or that shopkeepers are replacing electric lamps wholesale, is not only very gratifying to the gas interest, but it creates an "atmosphere" which is worth a great deal in hard cash. Its influence extends to every street in the town. One may perhaps be excused for saying that it cannot be easily understood how electrical engineers (or is it the Committee or directors ?) can stand idly by while the gas authorities regain their old superior position, yet this is the state of affairs in many towns. Criticism was advanced by a few who said that to spend money without an assurance of a profitable

return was madness, and was not business; but these critics were silenced by those who were accustomed to spend money on advertisements and on selling below cost, if necessary, in special cases to secure a market. Nothing is heard from these critics to-day.

The great advantage of the special arc circuit is that it can be controlled, and the Early Closing Act has assisted in this respect. The circuit is only alive during the proper hours and on business days, so it is not necessary to watch the consumers, or to put in time switches or meters.

Using a three-wire circuit, lamps may be wired very simply and cheaply by running the outers only through a double-pole switch, and tapping the lamps off alternately.

The lamps are of the General Electric Co.'s magazine flame type, burning 60 to 70 hours. The trimmer goes round at fixed intervals, fills up the magazine, and cleans the lamp. Single-carbon lamps are at a disadvantage, because it would not pay to call at irregular intervals to see if lamps needed trimming.

Lamps must be used which will give either a white or a yellow light at will—consumers must have the choice, and they change their minds occasionally.

The lamps must be very good; an unsteady light or a sticky mechanism would be fatal to success.

The steadying resistance should be inside the lamp. On a 50-volt circuit it is quite small. In the lamps adopted, it consists of a resistance wire wound round a porcelain rod, and it supports itself.

The single burning lamp is very simple, no substitutional resistance or cut-out is required, and it is cheaper for that reason. This saving goes some way towards paying the cost of the special cables. It is also a steadier lamp than the series burning type, in which one lamp may affect another.

In considering the financial side of this question, it will be convenient to take all the standing charges, and after deducting them from the revenue, see what price is available per unit for the electricity. It is assumed that a 50-volt lamp installation, running 700 hours per annum, is to be taken.

	Capital cost.	Life.	Annual capital charges—int. 3¾ % and repayment.
25-KW. motor-generator... ...	£150	15 years	£14
Mains—allow	300	25 ,,	21
Lamps (50 magazine type) ...	387	7 ,,	64
Wiring, 50 lamps...	50	10 ,,	6
Total capital charges			£105
Running charges, carboning and cleaning (assuming magazine arcs) 10s. per lamp per annum		£25	
Repairs, say		10	
Carbons, 700 hours at 15d.—8s. per lamp ...		20	
			55
			£160
Revenue—50 at £5			£250
Balance for energy			£90

This allows for 14,500 units at 1½d., which is not a very high price, it is true, but it must be considered that this price has only to cover generating costs and feeder costs, and has to bear no share of distribution expenses, as the cost is dealt with right from the motor-generator to the lamps, including mains and wiring. If one had even 1d. per unit for the electricity, it would pay to take the matter up, on the ground that a small loss or profit is of little importance compared with the advertisement.

At Wednesbury the cost of a motor-generator has been saved; a battery booster, used for charging the regulating cells, has been brought into use. It is not often that the battery is charged to gassing during shop hours, so that the one machine carries out the two operations. The booster armature has been provided with slip-rings and middle-wire gear, this being used only on the arc lighting circuit. The estimate allows for an entirely separate machine.

The illustration on p. 248 shows the effect of running the special low-voltage main in a street off the Market Place. It will be noticed that the shops are quite small, and are not of the kind which usually go in for arc lamps. Of the six shops illustrated, there is only one with two lamps, and it is safe to say that without the special main not one of these shops would be using arc lamps, or, indeed, any outside lighting. The writer, of course, might have shown a view of important shops in the Market Place, but thinks this side street is far more eloquent testimony to the advantages of the low-voltage main for outside lighting.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Screw Caps for Radiator Lamps.

As the use of radiators is extending so rapidly, it is most important that every detail of their design should be entirely satisfactory before it is standardised. Is this not a matter, therefore, for the B.E.A.M.A. to decide, by common action between the leading radiator manufacturers and possibly the supply authorities, what type of lampholder they should be fitted with in future? It is evident that any lampholder with springs must sooner or later give trouble, and the points of contact on the plungers of the B.C. holder are too small for the necessary heavy current that passes through them.

The above authorities could easily decide then what was the best lampholder to be fitted, and standardise it accordingly; whether an improved form of B.C. holder like the "Mumps," or a good Edison screw holder, or any other more suitable type. I hope, therefore, that you may be able to persuade the powers that be to take some prompt action in this matter.

Jobber.

Costs of Running Small Generating Station.

Would any of your readers be kind enough to give me information as to the running costs and upkeep of a 500-H.P. suction gas or crude oil electric generating station, or of one somewhere near this capacity?

E. B. Gray.

Maldon, *February 6th*, 1913.

Testing the Continuity of Earth Conductors.

In reply to the letters of "Continuity" and Mr. B. T. Davies on the subject of Mines Regulations, Rule 8 (*b*) and Rule 14 (*c*), if "Continuity" henceforth orders his cables as recommended by the Engineering Standards Committee, and in conformity with Rule 12 (*e*), he will have no difficulty.

If he intends earthing cables installed previous to the regulations coming into force, Rule 8 (*b*) points out plainly what to do.

The easiest way out of the difficulty would be to install a bare copper conductor of half the sectional area of the cable to be earthed, if he is dealing with two-core or multicore cables. This could be fixed to all the apparatus on the cable, and to the cable itself at intervals, and latterly brought to the surface and earthed. Of course, if "Continuity" had an armouring already on his cables which was not up to the standard, he could calculate the resistance of one of his main conductors against that of the armouring, find the deficiency in the latter, and make up with copper, so that the resultant would conform to the 50 per cent. regulation. In this case he would save the expense of putting in a conductor of half the capacity of his cable. At joints or distribution boxes, where a break in the main cable takes place, a bonding cable equal to 50 per cent. would be used to join the armouring. I use heavy brass split glands for this purpose, the cross bond being sweated directly into a hole in one lug of a half-gland, no sockets being necessary.

I think, however, that the best method is not to consider the armouring of an old cable, but to go right ahead with a proper earthing system. It is surprising that there are not more accidents with some of the so-called earthing systems in use to-day. I say at once that proper earthing is *the*

factor of safety governing a mining installation, and it can be made a very efficient and material one at that. I find no difficulty, and do not scruple in this respect.

The new regulations are easily complied with, and call for a standard of material and work that not only gives safety, but efficiency and immunity from breakdown. Undoubtedly they might be more explicit on some points, but what about the Insurance Act?

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Then, again, it is not applicable where cables are installed in accordance with Rule 12, Sub-sec. (*e*) (v)—that is, in conformity with Rule 15 (*i*).

When cables are installed in fiery mines, open sparking must be prevented (in case of roof falls, &c.). The manufacturer gets over this by making double wire-armoured cable, with a heavy layer of jute or lapping between the armourings, and the whole covered with a layer of jute. This is the class of (three-core) cable that should be installed everywhere; it pays in the end. Now where this class of cable is used, it would be useless to fix a local earth plate in the mine to the outer armouring only, and it is obvious that to open the outer armouring to get to the inner defeats the purpose for which the cable was made, to say nothing of destroying the waterproof and fireproof qualities of the cable, and adding to the resistance of the armouring by the insertion of a more or less perfect mechanical joint if installed where Rule 15 applied.

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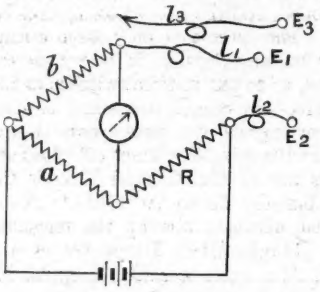

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Let E_1 = earth to be tested; E_2 and E_3, two auxiliary earths; l_1, l_2, l_3, the leads from the bridge.

Consider for simplicity that $a = b$, and that l_2 and l_3 are included in E_2 and E_3; if—

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It will be noticed that the values l_2 and l_3 are not required separately. I should like to see some correspondence on the rules under discussion from other mining electrical engineers. With apologies to Mr. Davies, and thanking you for publicity.

John P. C. Kivlen.

Uddingston West, *February 8th*, 1913.

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In your issue of January 3rd, page 6, we are very much interested in the correspondence covering the earthing of neutral, particularly because of the fact of the similarity of the scheme shown with that which we have had in use on our system since 1907. Our power system consists of:—

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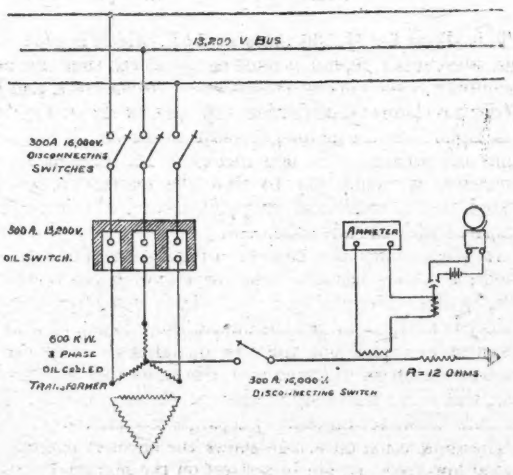
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In view of the fact that some of these units are not star connected, and also the multiplicity of units, we considered it undesirable to earth the neutral of the generating sets.

Therefore, the system which we show on the enclosed diagram was proposed in 1906, and was actually installed in 1907, and has been working very satisfactorily ever since. The oil switch on this equipment is of a non-automatic type. The 600-KW. transformer is specially wound to withstand the mechanical strains due to excessive overloads for short periods. The resistance in the ground leg consists of cast grids, and is proportioned to withstand a current of 500 amperes for one-half minute without undue heating. The 13,200-volt outgoing feeders are all equipped with triple-pole relays at the sending and receiving ends. The underground cable system has a charging current of 60 to 70 amperes per leg. The alarm relay is adjusted to notify the operator when this ground current exceeds 40 amperes. As our load is entirely a balanced one, you will see that ringing of the ground bell gives the operator warning of impending trouble on the system.

Before the installation of this neutral transformer, we had a considerable amount of trouble on our underground high-tension cable system, due to surges. In one case five separate burn-outs occurred at widely separated points on the system. Since that time we have been remarkably free from such trouble, for ordinarily we are able to detect the trouble before a serious ground or short circuit occurs.

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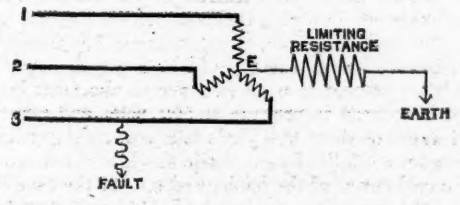
Minneapolis, U.S.A., *January 29th*, 1913.

In your issue of January 31st Mr. Fedden is good enough to fall in with my request, and gives some figures taken under actual working conditions with the special earthing transformers installed at Sheffield.

The figures show clearly that the neutral point of the transformer coincides more or less closely with the neutral point of the system, even when one of the phases is earthed and a current of some 50 amperes is flowing through the fault. In his letter published in your issue of January 3rd, Mr. Fedden suggested that not only was this the case, but that the neutral point of the system would itself be kept at earth potential under similar conditions. That this cannot actually be the case when one of the phases has broken down to earth is, I think, clear, when it is remembered that the point marked E in Mr. Fedden's diagram is separated from



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It should be noted that in Mr. Fedden's diagram the resistance is shown in the line F (which presumably represents an artificial fault), whereas it should, I think, be shown between earth and the point E.

The state of affairs on the occurrence of an earth would then be as shown in the accompanying figure, from which the mesh-connected secondaries of the transformer have been omitted for the sake of clearness. Under these conditions, the point E must be raised above earth potential by an amount equal to the phase voltage of the system.

The net result, therefore, would be almost precisely the same as if an earthing resistance had been joined up between the neutral point of the generators or transformers and earth in the usual way, and while, under the special conditions prevailing in Sheffield, the arrangement had doubtless many advantages, it would hardly seem as though the greatly increased cost would be warranted in the majority of cases. This being so, it may be of interest to see how far the various advantages enumerated by Mr. Fedden, in his first letter, are shared by the earthing resistance arrangement. Taking them in order, we have :—

1 and 2. With the neutral points of the generators connected to an earthing bar, and thence through a resistance to earth, no trouble is experienced in practice from triple-frequency currents, so that it is unnecessary, in the majority of cases, to take any special precautions with a view to preventing more than one generator being earthed at one time. Should trouble be anticipated from this cause, a resistance between each of the neutral points and the earthing bar will limit the triple-frequency currents to any desired extent.

3. The earth current can equally well be limited to the minimum value necessary for tripping any of the well-known earth current discriminating devices, and by this means the faulty feeder alone is cut off from the bus-bars.

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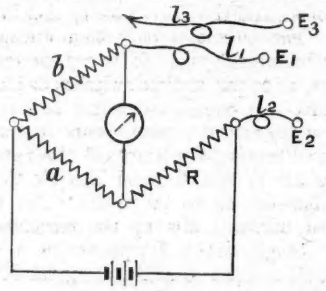

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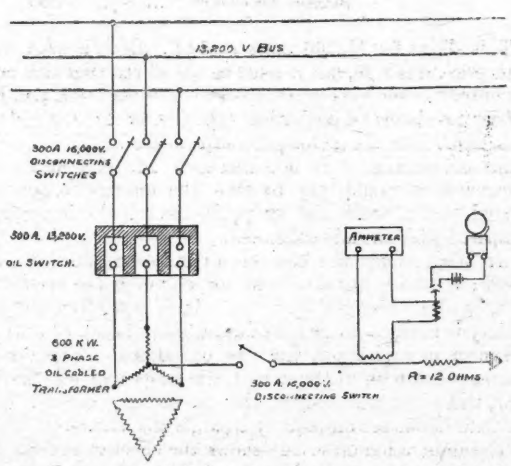
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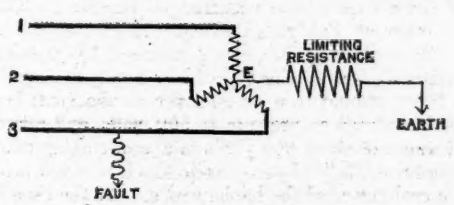

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The general report of the Chief Inspector of Mines for the year 1911 (Part II) contains a report by the Electrical Inspector of Mines, in which he says that electricity was newly introduced into no fewer than 46 mines in 1911, as against 40 in 1910. Under Rule 15 of the Electricity Special Rules, notice of the intention to introduce electricity must be given to the district inspectors, and 46 such notices were received. Of these 20 were in Scotland, four in the Newcastle district, two in Durham, two in Liverpool and North Wales, 13 in South Wales, and five in the Midland and southern district. Unfortunately, no particulars of the installation are required to be given under this rule, but from such particulars as are available, it appears that high-pressure alternating current was introduced in five mines, medium-pressure alternating current into 11 mines, medium-pressure direct current into 13 mines, and low-pressure direct current into four mines. In the latter cases the current was introduced for lighting purposes only. Under the new rules, however, which came into force on March 9th, 1912, full particulars of the installation must be given so that "a complete classification of the different systems of distribution, together with a measure of the growth of the use of electricity in mines, will be possible for the future." The fact that 46 mines newly introduced electricity is most satisfactory, and we are of the opinion that the new rules—which insist upon more attention being given to the design, installation, and use of electrical machinery than has hitherto been the case—will so far improve matters and lessen the number of accidents, that all the old objections as to its being a serious danger in a mine will be entirely removed and its progression will be by leaps and bounds. The most dangerous employment of electricity is admittedly that of coal-cutting, but in 1911 there were 998 electrically driven coal-cutters at work, an increase of no less than 125 over the year 1910. We will return to this question later on, and in the meantime it will be interesting to briefly review the inspector's reports of accidents due to electricity.

During the year 1910 there were in all 21 fatal accidents causing 21 deaths, but for the year 1911 there were in all only 14 fatal accidents causing 15 deaths. Of these, how-

ever, two of the accidents had, strictly speaking, no connection with the use of electricity in or about mines, though they were reported to, and investigated by, the inspector of the district. In one which occurred at New Great Rocks Quarry (Derbyshire) the deceased—who was a labourer—was on the roof of a building with the foreman deciding what repairs were required, when he either fell against or took hold of two live wires and was killed. In the other, two men each received a fatal shock from a live stay wire supporting the poles of a 3,000-volt three-phase transmission line about half-a-mile distant from the Lower Duffryn Colliery in South Wales. It appears that additional poles were being erected between the original poles in order to carry larger conductors, and the night before the accident an intermediate pole had been fixed adjacent to a pole where a line took a turn at right angles, in such a way that an undue strain came upon the cross-arm which canted, causing one of the insulators to be drawn from its support and allowing the conductor to come in contact with a stay wire supporting the pole, and by way of cradle—or we suppose guard wires—made a metallic connection with the next post where the men were killed. The leakage caused the pole to char, and the smoke being observed by some men engaged excavating lower down the mountain side, the foreman sent one of the men to investigate, and this man evidently came in contact with a live stay wire and was killed. Shortly after, another of the workmen, going for tools, had to pass the place, and he, too, received a fatal shock—no doubt while trying to rescue the first man. Evidently the great strain due to overhead wires had been under-estimated by the colliery people, and this accident may at least serve to draw their attention to the necessity of having these particularly strong—with braced corner poles, and as few stay wires as possible. Overhead lines are, and will be more so in the near future, an important part of the colliery installation, and they deserve more attention than they have hitherto received. The other overhead transmission lines of the company were all fitted with the Merz-Price leakage cut-out apparatus, and this device has since been applied to this line. We would strongly recommend other colliery proprietors who have important overhead transmission lines, to fit this really useful piece of protective apparatus if they have not already done so.

Although these accidents, as already stated, cannot be said to have any bearing upon the use of electricity in mines, yet they were quite rightly reported and investigated. If, however, we leave them out, the figures for 1911 directly comparable with the figures for 1910 are : 12 accidents, resulting in 12 deaths, or nine fewer fatalities in 1911 than in 1910, which is a distinct improvement, though the number is still regrettable, when one considers that most of them at least might have been prevented had the installation been laid down and worked with that care and attention which its importance demands.

Of the 12 fatal accidents then, 11 were due to electric shock, whilst the remaining one was due to ignition of fire-damp by electricity in an underground motor room. According to districts, five occurred in Scotland, two in Newcastle, three in Durham, one in South Wales, and one in the Midland and Southern district.

In the Scotland district four of the accidents were underground and one on the surface, and, in addition seven persons were injured (six underground and one on the surface). As compared with 1910, the Inspector for the district, speaking of underground accidents only, says:—"This is a decrease of one fatal and six non-fatal accidents," but adding the fatal "surface" accident, the number of fatalities is exactly the same. The Inspector fully bears out the views we have repeatedly expressed when dealing with colliery electrical accidents, for he says :—"Several of the accidents, if certain means had been taken by the officials, or more care had been exercised by the persons in charge of and working the machinery, would, in all probability, have been prevented, and I, therefore, give a . . . detailed description of them . . . so that the suggested precautions may be fully considered. Such precautions will, I trust, be adopted where they apply by those in charge of electric installations."

Two of the accidents were in connection with coal-cutting machines, and raise the question as to "whether a pressure which would be unlikely in case of accident to have fatal results, should not be used for all portable motors wherever it is possible."

We have previously expressed the view that all portable motors, such as are fitted to coal-cutters, should be of low-voltage, and it is encouraging to find an Inspector supporting this view. He (the Inspector) says : "Both accidents took place on medium pressure alternating current systems, and in both cases had the pressure been transformed to, say, 200 volts at the nearest convenient point to the portable motors, and if the neutral point of the transformer windings on the secondary side had been earthed, the persons who were unfortunately killed could not have received shocks of more than 130 volts to earth, and, therefore, would probably not have been killed. The two fatal shocks were, in fact, received from three-phase alternating-current systems of 550 volts in one case and 500 volts in the other. Mr. Nelson (Electrical Inspector), when making inspections in the division, has recommended the system, and I have also suggested that it should be adopted at several collieries, but objections have been raised that the size of the coal-cutting machines would be increased, and that the trailing cables would be so heavy as to become unwieldy."

These objections were, however, mainly imaginative, for careful inquiries put to the makers of coal-cutting machines elicited the reply that the increase of size would be trifling, and that the height—which is the chief point to be considered in a coal-cutter, would *not* be increased ; and as regards trailing cables, the weight due to the increase of size could be met by making them shorter, and using a larger number of junction or "gate-end" boxes for a given length of face. And, as the Inspector points out, "This latter would, in many cases, be an advantage rather than the reverse, as, instead of a long length of trailing cable dragging along the pavement of a face, a greater length of cable would be in the gate roads, where it could be properly suspended," or at least, properly protected. "I venture to think that it behoves everyone connected with the use of electricity for portable motors in mines to give this suggestion their careful consideration. If the system were given a trial, it would, I feel sure, be found that the supposed objections do not exist, *with the great advantage, from a safety point of view, that very few, if any, fatal accidents would occur* on portable machinery." The italics are ours, and we hope that both colliery managers and manufacturers will give these words the serious attention they deserve.

As to the accidents, one occurred at Bredisholm Colliery and the other at Bardykes Colliery. In the first the supply is on the three-phase system, at a pressure of 3,000 volts, and from a sub-station at the top of No. 2 pit the current is carried below ground to a transformer at the shaft bottom, where it is reduced in pressure to 500 volts, and carried inbye a distance of about 600 yards to a coal-cutting machine. The deceased was killed by an electric shock received probably from the coal-cutter of the haulage rope. At the time of the accident, there were two faults on the 500-volt distribution system, (*a*) a fault on one phase due to a breakdown of insulation a few feet from the transformer, (*b*) a second fault on a second phase due to the same cause at the coal-cutter. The frame of the latter was earthed by means of armouring of the trailing cable, and that of the main cable to earth-plates sunk at the surface, and there was a set of fuses at the gate end box in the coal-cutter circuit set to blow at about 80 amperes. The resistance of the armouring of the trailing cable was, when tested after the accident, found to be 6 ohms. The first of the two faults probably accelerated the appearance of the second by making the system temporarily a system with one phase at earth potential, as this made a connection to earth of some resistance probably very low. The fault at the coal-cutter caused another phase to be earthed, and the resistance between the two faulted phases would be made up of the resistance to earth of each of the faults plus the resistance of the armouring of the trailing cable and the main cable. Thus the resistance in the armouring of the trailing cable alone was such that to pass a fault current of 50 amperes a pressure of 300 volts or more may have arisen on the coal-cutter frame, a condition of things which clearly explains the accident.

At the Bardykes Colliery the current is also generated on

the three-phase system at 500 volts, and armoured cables are used throughout, except the trailing cables, which are provided with a fourth core for the purpose of earthing the frame of the coal-cutter to the armouring on the main cables. A coal-cutting machine had been left standing for about 15 minutes with the end to which the trailing cable was attached directly under a break in the roof from which a small stream of water was falling on to the trailing cable plug or attachment to the machine. This caused a breakdown of the insulation of the leads, and the frame of the machine to become "live," and the deceased man who was in contact with it, received a fatal shock. On investigation it was found that the pin which was provided with a collar for the purpose of making the "earth" connection when screwed into position, was too long, and the collar could not be screwed tight, and the earth connection was therefore not efficiently made, and as soon as the fault developed the accident occurred.

We are inclined to think there is an impression in connection with colliery working, that anything will do for an earth connection, and we are afraid that too much reliance is being placed upon the armouring of cables—and more especially when long lengths are considered—as necessarily they must fail if any heavy current is to be passed. It would have been interesting to know in the case of the Bredisholm accident, if the resistance of the trailing cable alone was 6 ohms, what the total resistance was. As we have frequently pointed out, it does not follow that because the armouring may be in contact with the walls of the mine, it is, so to speak, making by these contacts paths for the easy dispersal of leakage current through the strata to the "earth plates" which are sunk at the surface, but the armouring itself may—and in most cases we venture to think it does—form the only path for leakage current, and, consequently, if this should be high in resistance, as was the case in this instance, naturally it cannot be looked upon as a perfectly safe method of "earthing" any system. As the Inspector says: "It is obvious that if the resistance of the earth wire to the coal-cutter had been a fraction of an ohm, say, 0·6 ohm instead of 6 ohms, the fuse protecting the circuit would have been called into operation, and, almost certainly, without danger to the men, as the fuse would have blown before the pressure on the coal-cutter frame could have become dangerous."

As regards the other accident, it is not, we think, the first time an accident has occurred through a fault in the connecting bolt, or, at any rate, in the "efficiency" of the connection; and then, as the Inspector points out, "the plug should not have been allowed to be under the stream of water. Any unearthed machine frame not perfectly water-tight would become alive in these circumstances, and those in charge should have taken steps to protect the machine from the water by temporary means, or, if that were impossible, they should at once have switched the current off," and as regards the defect in the clamp pin, "these are matters which should be constantly inquired into by the higher officials and electricians," with which we agree, but it is just one of these little things which the "higher" officials have no time to deal with, and it would be much more satisfactory to instruct the man in charge of the machine not to put it to work unless every little detail was in perfect order, or if something goes wrong not to start the machine again until it is put right.

At Devon Colliery, where a road repairer was killed, three-phase current is generated at 650 volts, and the system is entirely insulated from earth. The current is carried underground by an armoured cable, and from a distribution box near the shaft a three-core unarmoured Dialite cable is carried into the seam to a distribution and switch-box, and from this box three single-core unarmoured Dialite cables are carried to two gate end boxes into two districts where coal-cutting machines are in use. The coal-cutter frames were earthed through a fourth core in the trailing cable to the gate end boxes, and from these 7/16 galvanised iron wires with soldered joints were carried from each district and joined together near the distribution box, and from thence continued by only one wire to a copper earth plate 2 ft. × 2 ft. × ¼ in., to which it was bolted by a lug. The plate was placed in a clear water hole 6 ft. by 4 ft. by 3 ft. deep, and a good flow of water passed over it on its way to the shaft. In moving the cables to carry out some repairs, one of them by some means or other "was hanging on top of the earth wire," and deceased was seen "twisted with his arm over the earth wire." Evidently the insulation of the cable had broken down, as "on the day following, or two days after the accident, Mr. Masterman found the cable had a hole ¾ in. × ⅜ in. deep in it, the copper was pitted, and the insulation was also burned. A galvanometer test on the earth wire gave continuity, but the galvanised wire which was in the water-hole at the earth plate was *extensively corroded*. There were 9 ft. of wire under water, and some parts were worse corroded than others. He broke off one strand in bending the wire, the length of which was about 3 in., but the worst and, I think, the vital part was close to the lug, as four of the strands were eaten through and the remaining three looked less than $\frac{1}{16}$ in., one of them being nearly half eaten away." Again, "the accident was due to the earth wire not being of *sufficient capacity* to disperse the leak without danger. The earthing system would have been more satisfactory if the earth cables had had greater conductivity . . . . and if in addition to the earth plate below ground, the cables had been taken to a plate sunk at the surface." The italics are ours, and here again the impression that anything will do for an earth wire seems to have existed, and we may suppose that by putting the earth plates in running water, certainty of perfect "earth" would be doubly assured. To bury plates in a pond, whether of still or running water, is not necessarily ensuring good earth conditions, but often the reverse, and whatever was the reason for putting the earth plates below ground? And why should they mix up their cables with (1) an armoured shaft three-core cable; then (2) an unarmoured three-core cable; and (3) finish up with three single-core cables?

(*To be continued.*)

LEGAL.

LITHOLITE, LTD., *v.* TRAVIS.

IN this case, Mr. Justice Joyce heard a motion in the Chancery Division on Friday, February 7th, to restrain the defendant from disclosing trade secrets or secret processes which came to his knowledge while in the employ of the plaintiffs as their works manager at Hackney Grove, and to restrain him from infringing plaintiffs' copyright in their catalogue or price-list of standard litholite and litholite articles.

MR. HUGHES, K.C., on behalf of the plaintiffs, said this was a serious case. The plaintiff company made electric fittings of a substance known as litholite. This was not a patent, but was made by a process known only to themselves, and they had a very large trade in bushes, handles, and other insulating appliances. In October, 1908, they employed Mr. Thos. Travis, the defendant, as their works manager, and a formal agreement was entered into in November, by which Mr. Travis agreed "to make over any new processes discovered by him during the time of his service or three years afterwards, and not to disclose any (of the plaintiffs) trade secrets, or secret processes of manufacture, or to use them apart from the company." Under that agreement, Mr. Travis worked for three years—until, in fact, he had acquired a full knowledge of the plaintiffs' business. That he had no such previous knowledge was shown by a letter written when applying for the post in 1908. In that, Mr. Travis said, "As I do not possess experience practically in your business, I would be the more zealous to acquire full and early competence." In January, 1912, Mr. Travis left the plaintiffs' employ, and it would appear that it then occurred to him to form or promote a company for the purpose of taking advantage of the knowledge he had acquired. Accordingly, in May, 1912, Insulators, Ltd., was incorporated, with a nominal capital of £2,000, of which Mr. Travis held £1,250 or £1,350, and two Manchester men named Carney and Smith held the rest. The office of the company was Hyde Road, West Gorton, Manchester. With that company, Mr. Travis entered into an agreement to act as manager, and to disclose all knowledge he had of the manufacture of electrical apparatus and details of manufacture. It was clear from the evidence that the company had manufactured electrical apparatus of the same substance as plaintiffs' manufacture, and which they called litholite. Further than that, the defendant company had copied the catalogues or price list of the plaintiff company and made use of the copies.

HIS LORDSHIP: What do they say about that?

MR. HUGHES: What is said is that the knowledge Travis is making use of on behalf of Insulators, Ltd., is not knowledge acquired in the service of the plaintiffs, though I think that can hardly be true in view of his letters.

An affidavit by Mr. Alexander Russell, of Faraday House, was read, in which the deponent said that on chemical analysis he found the litholite made by Insulators, Ltd., to be made of the same ingredients, in substantially the same proportions, as that produced by the plaintiffs.

Proceeding, Mr. Hughes also read an affidavit filed by the defendant Travis, in which he said he had not disclosed any secret process, and it was not true that litholite was manufactured by the plaintiffs by a secret process; further, that litholite had been used by one Charles Hesse, who had described it in a posthumous work as made of sawdust, dried blood, and bichromate of potash; and that in a catalogue issued by the plaintiffs themselves, litholite had been described as made of earths, resins, and fossil gums. Further, that recipe of litholite was contained in a book published as early as 1886.

An affidavit in reply by Mr. Walter Theodore Hunt, of the plaintiff company, was also read by Mr. Hughes. In this Mr. Hunt said that plaintiffs' insulating material was not made of sawdust, dried blood, and potash, nor of earth's resins and fossil gums, as Mr. Travis inaccurately asserted to have been stated in a catalogue. The catalogue in question showed, said Mr. Hunt, that the insulating material made by his company was compounded of silicas carefully selected, fossil resins, &c., and the recipe did not appear in the book referred to.

Mr. Shaw Cooper, on behalf of the defendant, argued that the process of manufacturing litholite was common knowledge such as he was entitled to use; and with regard to such a matter the agreement was not binding since it would be in restraint of trade if defendant should be restrained from using any process which was common property.

His Lordship: Why? You are taken in to work certain processes for your employer, and you promise you won't use them apart from the employment. However, that may be a question for the trial.

Mr. Shaw Cooper said that in the Technico Chemical receipt book published in 1886 and reprinted in 1895, there was a recipe for litholite used, in fact, by the defendant. This gave the components as mineral wax, asbestos, and tar. It was admitted that both the litholites were made by the same process, but this process was not a secret. In the letters of 1908, no doubt, Mr. Travis said he had no practical knowledge, but he had chemical knowledge which he might always make use of. There was no inconsistency between these statements.

His Lordship: He has stolen part of his late employer's catalogue.

Mr. Shaw Cooper denied that this was stolen; all that the man had done was to copy to save himself expense. However, he would not resist an injunction as to the catalogue. As to the other things, no injunction should be granted.

His Lordship, in giving judgment, said, in his view, Mr. Travis was a very clever and unscrupulous person, and on the evidence the plaintiffs had proved quite enough for an interlocutory injunction. Defendant had certainly stolen part of the plaintiffs' catalogue, and, he believed, had violated the plaintiffs' secrets. On the usual undertaking as to damages in case his Lordship should prove to be quite wrong in his opinion (as he might be), and in case the defendant might succeed at the trial, he would grant an injunction.

The Osram Lamp Works, Ltd., *v.* The Ora Light Co.

In the Chancery Division on Friday, February 7th, Mr. Justice Swinfen Eady had before him a motion in this action.

Mr. Gray said it was a motion for an injunction. The parties had agreed that the motion should be treated as a trial of the action, and there should be an injunction by consent.

His Lordship: An injunction for what?

Counsel for defendants said that he was instructed to agree to an injunction during the continuance of the letters' patents in the terms of the notice of motion, restraining defendant company from selling any lamps which were infringements of plaintiffs' patents, the motion to be treated as the trial of the action.

His Lordship: That is an end of it then. Defendants pay the costs?

Counsel: Yes.

His Lordship: Very well, treat the motion as the trial of the action; a perpetual injunction, and defendants to pay costs. Also an inquiry as to damages.

The Osram Lamp Works, Ltd., *v.* Louis Schloss & Co.

In the Chancery Division, on Friday, February 7th, Mr. Justice Swinfen Eady had before him a motion in this action to restrain infringement of plaintiffs' patent rights in regard to electric lamps.

Mr. Gray appeared for the plaintiffs, and said that he understood the defendants wanted a fortnight's adjournment to get evidence from abroad.

His Lordship: Where from?

Mr. Frost, for the defendants, said they desired to obtain evidence from Brussels and Italy. The defendants in this case were not the manufacturers of the lamp complained of, "The Edna." They were under the impression that the filament of the lamp was manufactured by a firm in Brussels, but they had since discovered that it was in fact made in Milan. He (counsel) was assured that the filaments in question were made by a process quite outside the plaintiffs' patents.

His Lordship allowed the matter to be adjourned for a week.

Edinburgh Tramway Accident Verdict Set Aside.

In the First Division of the Court of Session, judgment was given in the application for a new trial by the Edinburgh and District Tramways Co., Ltd., in the action against them by a domestic servant for damages in respect of injuries. When the case was tried by Lord Hunter and a jury, a verdict was returned for pursuer, and the damages were assessed at £350. The First Division held that the verdict could not be allowed to stand, and assoilzied the defenders.

The Lord President held that it was pursuer's own negligence that led to the accident. On the question of expenses, the Court appealed to the company not to move for expenses, and counsel for the company agreed.

Glasgow Tramway Accident Claims.

Lord Dewar, in the Court of Session, has approved an issue for the trial by jury of an action by a vanman against Glasgow Corporation for £500 damages for personal injuries. Pursuer, whose van was run into by a car, attributes fault to the driver, while defenders deny liability, and allege that pursuer was not keeping a proper look out. In another action brought by a Govan riveter, the Corporation is sued for £1,000. The contention is that the car which knocked him down was going at an excessive speed.

Hughes *v.* Hobart Electric Manufacturing Co.

Judge Allen, at Nottingham County Court, gave judgment for the defendants in an action brought by Mr. H. K. Hughes, of Nottingham, against the Hobart Electric Manufacturing Co., of America and London.

Plaintiff, who claimed £4 3s. 8d. for goods delivered, stated that he was formerly the tenant of a shop in St. Peter's Gate, Nottingham. He intended to leave the premises at the last March quarter-day, and the defendant company desired to enter the premises a fortnight before quarter-day. Mr. Forbes Leith, who described himself as the northern manager of the company, told Mr. Hughes that they wanted to take the shop as soon as possible, and plaintiff said he would forgo the fortnight's rent if Leith would give him the order to execute the lighting. To this Leith agreed, and the lamp, which was the subject of the present claim, was fixed, but when plaintiff sent his invoice to the company, they repudiated it, and referred him to Mr. Leith.

For the defence, Mr. Wright, the European manager of the company, stated that Leith was never their northern manager, and had no authority to order goods on behalf of the company. He was their district sales agent, and when witness found he had put up a plate describing himself as manager, he instructed him to take it down. He had no authority to pledge the company's credit.

Winding-up Petitions.

The Rapid Magnetting Machine Co., Ltd., petitioned in the Companies' Court, before Mr. Justice Swinfen Eady, on Tuesday, for the compulsory winding up of the Polack Manufacturing Co., Ltd. As there was a possibility of plaintiffs being paid, his Lordship allowed the petition to stand over for a month.

On Tuesday, in the Companies' Winding-up Court, Mr. Justice Swinfen Eady had before him the petition of the British Westinghouse Electric and Manufacturing Co., Ltd., for the compulsory winding up of the Garnant Anthracite Collieries, Ltd. Mr. Copping, for the respondent company, said the directors were in Paris, and they had hopes of resuscitating the company. The petition was dismissed, without costs.

BUSINESS NOTES.

Fifty Years' Success in New Zealand.—The story of the experiences of pioneers who went out to seek their fortunes in other lands many years ago, meeting privation and difficulty, and having to rough it, subsequently climbing over their difficulties, seizing opportunities, and building up a big fortune, always affords absorbingly interesting reading. And in these days of foreign and Colonial trade expansion, when nearly every other man appears to think that in order to get "on" he must get "out" of the country, interest in such achievements is not likely to lessen. We confess to feelings of admiration and almost envy at the progress of one of these pioneers and his associates, which we have been privileged to read in a brochure, "1862-1912," telling the story of the rise and progress of the firm of A. & T. Burt, Ltd., of New Zealand, which was issued on the occasion of their jubilee. Mr. Alexander Burt, the present chairman of the concern, went out from Scotland to Victoria in 1859, when 19 years of age, and after viscissitudes of many kinds, including gold-fever intervals, he started in New Zealand a small 15 ft. × 20 ft. workshop (plumbing and zinc working), being joined shortly after by a brother. The brochure tells of the advances, works extensions, new branches, engineers' shops, copper shop, lead-pipe making, core winding, iron-moulding shops, fitting shops, and so on, leading on to, or forming part of, the widespread business that the firm has to-day in Dunedin, Auckland, Wellington, Christchurch Timaru

Invercargill, Port Chalmers and London. The directorate consists of five "Burts," including the founder already named. The capital of the concern is £100,000. The firm are the New Zealand agents of Messrs. Siemens Brothers Dynamo Works, Ltd., to whom we are indebted for the loan of this interesting book, and for whom Messrs. Burt secured the Auckland Corporation electrical contract (£33,000), which is now in hand. The firm's electrical department was opened 10 years ago, and our readers who know something about the electrical development that has been and is proceeding in New Zealand, will not be surprised to learn that this department has gone ahead by leaps and bounds. The firm's workshops at Dunedin, of course, have their own electrical power installation.

Italy.—According to *Il Sole*, a Venetian financial group, at the head of which is Commendatore Nicolo Spada, has completed the studies for the construction of an electric tube railway under the lagoon, with the view of uniting the city of Venice with the Lido—the long belt of lowland separating the lagoon from the Adriatic. The object of the scheme is to relieve the congestion of population in the city and counteract the constant rise in price of land, by the utilisation of the building land, which will be rendered available on the Lido. The course taken by the tunnel will be in the direction of the Giudecca, the largest of the islands in the lagoon, connection with which will also afford an opening for the expansion of the population outwards. When realised the tube will necessarily lessen the navigation dues now paid by shipping crossing to the Lido, but this will be set off by the increased demand for energy from the city's generating station at Cellina, which will ensue.

Reduction of Capital.—Miller & Sons, Ltd.—A petition for confirmation of reduction of capital from £30,000 to £18,447 has been presented. Notice appears in our advertisement pages.

Book Notices.—*Manuel Pratique de Soudure Autogène.* By R. Granjon and P. Rosemberg. Paris: Office Central de l'Acetylène. Price 5 fr.—Naturally, this book deals only with acetylene welding, but it does so in a very complete fashion. The nature and properties of the blow-pipe flame, the various applications of autogenous welding, the manipulation of gas bottles and acetylene generators, the welding characteristics of the different metals, welding machines, &c., are all fully treated of, with numerous illustrations of the wonderfully clever work that is regularly accomplished with the oxy-acetylene flame. Anyone who is concerned with welding or cutting with the blow-pipe will find this book both interesting and instructive, and our only regret is that it is marred by a brief, but wholly unjustifiable and untrue, attack on electric welding.

Annuaire International de l'Acetylène. 1912. Price 3 fr.—This annual, by the same authors and publishers as the foregoing, contains a mass of information relating to acetylene and calcium carbide, in all their varied applications. The use of acetylene for lighting purposes is very fully dealt with; owing to the keen competition of electricity and coal gas, not a score of examples of public supply of acetylene exist in the United Kingdom, and the places named in the list given in the *Annuaire* are almost all villages of one or two thousand inhabitants. Our consumption of carbide for all purposes in 1911 was about 16,000 tons, an increase of 2,000 tons; the only factory making carbide in this country is that at Thornhill, with a production of 2,000 tons per annum. The principal producers of the world are Sweden and Norway, with a joint output of 52,000 tons a year, and the United States, 50,000 tons; next come France, 32,000; Switzerland, 30,000; Italy, 28,000; Austria-Hungary, 22,500; Spain and Portugal, 18,000; and Canada, 12,000 tons a year. The world's production in 1910-11 was 258,700 tons, exclusive of carbide for the manufacture of cyanamide, of which 20,000 tons was produced. A table of costs of various illuminants is given, accompanied by the remark, regarding electric lamps, that the candle-power falls off rapidly, and that this is an important consideration in view of the high cost of metallic-filament lamps. The writer of this libel ought to be aware that the candle-power of metallic-filament lamps falls off very little indeed, and that of arc lamps not at all.

Annuaire du Bureau des Longitudes pour l'Année 1913. Paris: Gauthier-Villars. Price 1 fr. 50.—This year the *Annuaire* contains, in addition to the astronomical data, tables relating to geography, statistics, metrology, &c., but not physics and chemistry, which will appear next year. One of the special articles is by Commandant Ferrié, on the application of wireless telegraphy to the transmission of time, which has in recent years assumed great importance. By this means comparisons of time at different places can be made to an accuracy of one or two hundredths of a second.

Recherches sur la Commutation dans les Dynamos à courant continu. By A. Mauduit. Paris: Dunod & Pinat. Price 9 fr.—In this work the author embodies a critical discussion of the theory of commutation together with the details and results of his own investigations. The first part deals with the development of the theory, from the work of Reid to the Arnold equation, and the successive steps in the elucidation of the numerous problems and difficulties met with in the endeavour to reconcile the phenomena observed in practice with the conclusions derived from theoretical principles. In the second part the author shows how he has endeavoured, by separate investigation of the many variable factors met with in the complex operation of commutation, to arrive at definite laws governing the relations of these and to deduce working formulæ for the guidance of the designer. He finds that contact resistance plays a much less important part in commutation than is generally supposed, and that consequently the accepted theories, based upon inaccurate hypotheses, lead to results of no great practical value.

The Arbitration Clause in Engineering and Building Contracts. By E. J. Rimmer, Barrister-at-Law. London: Constable & Co. Price 2s. net.—This little book states that the powers of an engineer under a contract for engineering or building works have been seriously undermined by recent decisions in the Court of Appeal and the House of Lords. The author considers the effect of these decisions, and suggests modifications which may be made in engineering contracts for the better security of the settlement of disputes by arbitration.

Electric Power Transmission by Aluminium Conductors.—By issuing this pamphlet, which brings together in convenient form a mass of information relating to the electrical uses of aluminium, the British Aluminium Co., Ltd., have benefited not only themselves and their clients, but also all engineers who are concerned with overhead transmission lines. The cost of aluminium conductors at present prices is about 40 per cent. less than that of copper conductors, and consequently the use of aluminium is extending in all parts of the world; the development of water-powers, which are usually situated far from large centres of population, tends to increase the importance of the subject, and many concerns of the first magnitude have adopted the metal for very extensive transmission undertakings. Particulars regarding the physical characteristics of aluminium wire, very fully detailed and compared with those of copper, are followed by tables of standard sizes, resistance and weight. The regulations laid down by various Governments for overhead lines are then given, and the restrictive effect of an excessive factor of safety is referred to, a value of three being recommended (used in France, Germany and Austria), instead of five, as specified by our Board of Trade; a factor of safety of two is often used in the U.S.A. and Canada, where probably more aluminium lines are used than in any other part of the world. The torsion-sleeve joint is recommended. Other tables are given which facilitate the calculation of transmission lines, as well as charts and diagrams, and data are included showing the relative costs of copper and aluminium lines, complete with towers and insulators, &c. The pamphlet will prove to be a valuable work of reference.

Abstract Bulletin of the Physical Laboratory of the National Electric Lamp Association, Cleveland, Ohio, U.S.A. Vol. I, No. 1. From the Laboratory.—This is the first published collection of abstracts covering all the researches carried out in the Laboratory from its inception, in 1908, to the summer of 1912, under the supervision of the director, Mr. E. P. Hyde, and is intended to bring together the principal results that have been obtained, the abstracts being fairly lengthy and fully illustrated. References are given to the various journals in which the original papers (28 in number) were published *in extenso*, so that those who desire more complete information will have no difficulty in obtaining it. The researches deal with a wide range of phenomena in connection with light and radiation in general, visual acuity, photometry and other matters relating to light and illumination, and represent a vast amount of original investigation of the highest order. The issue of this useful summary of the results obtained cannot fail to be of great service to those interested in illuminating engineering.

L'Année Electrique, Electrothérapique et Radiographique. By Dr. Foveau de Courmelles. 1913. Paris: Ch. Béranger. Price 3 fr. 50.—This annual review is now in its thirteenth year, and constitutes a summary of all the new facts and developments which have occurred during the past year in the electrical field. It is divided into chapters, each of which deals with a separate subdivision of the science, covering all its domestic and industrial applications, as well as the uses of electricity in therapeutics, references being given to the publications from which the information is derived, so that those who desire further details on any point can readily obtain them. Its scope is cosmopolitan, and as a handy record of the year's progress, it certainly fills a niche of its own, its popularity being attested by its arrival in its "teens."

The Engineer's Year-Book of Formulæ, Rules, Tables, Data, &c., for 1913. By H. R. Kempe, M.Inst.C.E. London: Crosby Lockwood & Son. Price 12s. 6d.—Some things are never appreciated at their true value until one is deprived of them, and from personal experience we can apply this saying to "Kempe's Year-Book," for having recently suffered the loss of our office copy, we have had it borne in upon us, more than ever before, that we cannot do without it. That we are not alone in this conviction is shown by the fact that the year-book is now in its 20th year of publication; it is quite a bulky volume, containing nearly 1,600 pages and over 1,250 illustrations. Much matter has been cut out, but still more has been added, and the process of division into sections, begun two years ago, has been continued, although it has involved, for instance, the rearrangement of the whole of the "Steam" section, which now consists of six parts. The part which relates to steam turbines has been entirely rewritten by Mr. H. L. Guy. There are new sections on Roads, Marine Diesel Engines and Legal Notes for Engineers, all by specialists, whilst very many existing sections have been revised and some have been largely extended. A novel feature is a summary of engineering progress during 1912, and, by special permission of the Engineering Standards Committee, abstracts of a large number of the Committee's specifications have been included.

To review the contents of this standard work would be as arduous as it would be superfluous; clearly it needs no recommendation. We shall be content, therefore, with saying that we give a hearty welcome to the new issue.

Sell's Directory of Registered Telegraphic Addresses. London. 25s.—As many of our readers know, this work is published annually, and is compiled from Official Lists supplied by the authority of the Postmaster-General. The 1913 edition contains 2,500 pages of names, postal addresses, telegraphic addresses, trades and telephone numbers. This year it contains the first Official List of the new "Indicator" words for London Telegraphic Addresses. In

addition to ordinary changes in style and in addresses of Registrants, there are about 20,000 "Indicators" added, necessitating the alteration of as many telegraphic addresses. An Alphabetical Index of the Registered Telegraphic Addresses in use throughout the United Kingdom forms Section II of the volume, and each address bears a reference to Section I where the names, postal address and full business particulars will be found. A useful division of the book is that containing a classification of trades for the whole country. There are over 3,000 separate Trade Headings, under which are arranged in alphabetical order about 100,000 British firms according to their respective trades or professions. The publisher has also added a representative list of Colonial and foreign firms, arranged by countries and towns, with their trade and cable address. The preliminary pages contain notes on Business Prospects for 1913; and one on the Post Office, 1911-12. To the business man the recital of the list of contents of the book is sufficient without any further commendation.

The South African Mining Directory and Monthly Handbook of Chief Officials of the Mines. Johannesburg: The *South African Mining Directory, Ltd.* No. 1. November, 1912. 7s. 6d.—The usefulness of this publication must be obvious from its title. To all interested in electrical and engineering trade with South Africa a frequently revised list of names of mine buyers, managers, engineers, electrical engineers, secretaries, &c., can hardly fail to be of value, in view of the changes that are taking place every month. There is an alphabetical list of mines on the Rand, also of "Outside" Transvaal and Natal gold mines, Natal collieries, copper companies, South African railways, Johannesburg municipalities, industrial concerns, and their chief officials. We notice a full list of the engineering officials and staff of the Victoria Falls and Transvaal Power Co., Ltd.

We have received a copy of the first number of a new American monthly contemporary, *The Lighting Journal*, which is edited by Norman Macbeth, and published at 10 cents per copy by the Lighting Journal Co., of 50, Church Street, New York. A number of useful articles relating to electrical and gas illumination—"everything between the meter and the eye"—appear in this number (January).

"Characteristics of Induction Type Alternating-Current Watt-hour Meter." By A. Ohya and R. Mitsuda. 1912. Tokyo: The Electro-Technical Laboratory.

"Mine Fires and How to Fight Them," by James W. Paul; "Accidents from Falls of Roof and Coal," by G. S. Rice; "Coal Mine Accidents in the United States, January to August, 1912," by F. W. Horton; "Training with Mine-Rescue Breathing Apparatus," by J. W. Paul; "Smoke Abatement and City Smoke Ordinances," by S. B. Flagg; "Ignition of Gas by Standard Incandescent Lamps," by H. H. Clark; "Methods for the Determination of Water in Petroleum and its Products," by I. C. Allen and W. A. Jacobs; "An Investigation of Explosion-Proof Motors," by H. H. Clark; "Comparative Fuel Values of Gasoline and Denatured Alcohol in Internal-Combustion Engines," by R. M. Strong and Lauson Stone. Washington: Government Printing Office.

"*Journal* of the American Society of Mechanical Engineers." February, 1913. New York: The Society. Price 35 cents.

"*Bulletin* of the American Institute of Architects." Vol. XIII, No. 3. October, 1912. Washington: The Institute.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 2. January 31st, 1913. With index to Vol. XVI. Milan: Stucchi, Ceretti & Co. Price L. 1.50.

"*Bulletin* of the Imperial Institute." Vol. X, No. 4. December, 1912. London: John Murray. Price 2s. 6d. net.

"Charter, Bye-Laws and List of Members of the Iron and Steel Institute, 1913." London: The Institute. Price 1s.

"The New Steam Tables." By C. A. M. Smith and A. G. Warren. 1913. London: Constable & Co., Ltd. Price 4s. net.

"Annual Report of the International Electrotechnical Commission, 1911." London: Waterlow & Sons, Ltd.

"*Journal* of the South African Institution of Engineers." Vol. XI, No. 6. January, 1913. Johannesburg: The Institution. Price 2s.

Proceedings of the American Society of Civil Engineers." Vol. XXXIX, No. 1. January, 1913. New York: The Society.

Bulletin de la Société Internationale des Electriciens." Vol. II, No. 20. December, 1912. Paris: Gauthier-Villars. Price 2 fr. 50.

"*Boletin* de Ingenieros." Vol. III, No. 4. December 16th, 1912. Mexico: Departamento de Ingenieros de la Secretaria de Guerra.

"Science Abstracts." Sections A and B. Vol. 16, part 1. January 31st, 1913. With indexes to Vol. 15. London: E. and F. N. Spon, Ltd. Price 1s. 6d. each.

Electrical Manufacturing in Japan.—The Shibaura Seisakujo Ironworks, at Shiba, Tokio, which doubled its capital to £200,000 in 1911 by combining its interests with those of the General Electric Co., of the United States, at the same time devoting itself to the manufacture of electric appliances, has met with such a heavy demand for its productions that the directors have now thought it necessary to increase the company's capital to £500,000.

Mazda Lamps for Stage Lighting.—The initial strength and long life of the Mazda lamp under most severe conditions of service are well shown by an incident which recently occurred at the Theatre Royal, Elephant and Castle; many of the drawn-wire lamps supplied by the B.T.H. Co. to the theatre are still in use after two years, burning an average of three hours a day, in spite of great vibration. The manager had 88 put in a stage batten some time ago, and in fixing it the whole iron frame and lamps were accidentally dropped about 10 ft. Only one bulb and seven filaments were broken. A similar incident occurred some months ago at the Prince of Wales Theatre, Birmingham. One of the scene-lighting battens containing 100 Mazda lamps was being raised, when the ratchet on the winch slipped. One side of the batten dropped a distance of about 5 ft., and then the ratchet re-engaged with a jerk. The lamps were unlighted at the time, and were, therefore, in their most fragile condition; but when they were switched on, it was found that not one had been injured.

Installation Contracts.—The following are some of the works that are being executed by Messrs. Hellyar & Sons, Ltd., of Barnes, S.W.:—

The "Firs," Chesham Bois.—Electric lighting installation.
St. James's Vicarage, Bury St. Edmunds.—Extensions to electric light installation.
Alterations to electric light plant at Rowallen, Haslemere, Surrey.
Temperature control, for the United Newspapers, Ltd., 12, Salisbury Square, E.C.
Two switchboards, for Messrs B. S. Lloyd & Co., King Street, E.C.
The "Beaufort Arms" Hotel, Monmouth, Wales.—Complete plant, lighting, heating and bell installation.
Electric light installation in the Church, North Camp, Aldershot.

Catalogues and Lists.—The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Four-page illustrated list relating to the casting of aluminium and the properties of metal for foundry work.

The Electric Construction Co., Ltd., 9, New Broad Street, London, E.C.—Four-page illustrated list No. B/317, containing description and tabulated prices of E.C.C. cinematograph motor-generators for C.C. and A.C. supply.

Messrs. Riehle Bros.' Testing Machine Co., Philadelphia, Pa., U.S.A.—Illustrated and other leaflets concerning the Riehlé testing machines for chains, cement, road materials, &c.

Messrs. Carson & Evans, 3, Fenchurch Buildings, London, E.C.—Postal card relating to their ebonite and vulcanite; also a folder giving particulars of a new and cheaper material known by the name "Carvanite," for meeting requirements where a lower priced material than ebonite or vulcanite is wanted.

Messrs. Eastman & Warne, 241, Acton Vale, London, W.—Small leaflet describing the "Belenus" electrically-heated branding irons.

The Electrical Co., Ltd., 122-124, Charing Cross Road, London, W.C.—New 20-page illustrated price list of their "Aegma" drawn wire lamps. Some notes on lamp manufacture are given. Also a folder entitled "Under Association Rules," stating a number of points in favour of the "Aegma" lamp. Wall showcard (approximately 10 in. × 15 in.) to advertise their "Aegma" drawn-wire lamps.

The Lea Recorder Co., 32, Deansgate, Manchester.—Two illustrated circulars: WI, giving a description of Lea's patent integrator for totalising the flow of water over V notches and weirs and W2 showing one of these apparatus supplied to the New South Wales Government for measuring up to 20,000 gallons per hour.

The Brimsdown Lamp Works, Ltd., Kingsway House, London, W.C.—We have received a set of eight picture postcards illustrating the various uses of "Wirum" lamps—including street, shop, ship and dock lighting, train and tram lighting, also private house and public building illumination.

The British L.M. Ericsson Manufacturing Co., Ltd., Beeston, Nottingham.—40-page catalogue (Section "H") in expanding binding cover. It contains excellent half-tone illustrations, descriptive notes, dimensions, weights, and code-words, of intercommunication telephone instruments of all types and sizes. Relay boxes, junction boxes, and cable are also particularised. A section of eight pages in the front of the book gives, in neat tabular form, prices of the different items listed. A line to which special attention is directed is the type HK 100 secret intercommunication table telephone for metallic circuits.

Messrs. M. K. Cooper & Co., 27, Oswald Street, Glasgow.—A number of illustrated folders and leaflets relating to the following: The "Regina" electric cleaner, the "Regina" pneumatic sweeper, the "Thor," electric home laundry machine, and the "Shaler" electro stove and electropad.

The British Thomson-Houston Co., Ltd., Rugby.—New publicity literature in their standard form and style as follows:—No. 397 (40 pages) fully illustrating and particularising a variety of overhead line material; No. 393 (eight pages), starting rheostats for C.C. motors; No. 394 (four pages), A.C. prepayment watt-hour meter (single-phase house service); No. 396 (four pages), overhead trolleys; No. 391 (four pages), electric flat-irons; No. 390 (four pages), brake magnets; No. 392 (four pages), electric soldering, branding and burning tools. Advance proof of new price list describing very fully, with illustrations, the B.T.H. hand-operated starting compensators.

Mr. H. Moss, 116, Horton Grange Road, Bradford.—Folder, (with 1913 calendar on front page) giving hints to electricity users; also a leaflet relating to country house lighting, describing the two-cylinder "Pelapone" lighting set.

The Birmingham Manufacturers' Supply Co., 17, Easy Row, Birmingham.—The firm are wholesale distributing agents for Messrs. F. J. Bayley & Co. (Mr. F. Sumner Bayley is a principal in the firm), and they have issued a brochure giving some particulars of "Susub" (suet and tallow substitute), and its applications as a lubricant, also testimonials from users. Any reader can, by applying, have a 10-lb. tin free for trial purposes.

The Sterling Telephone and Electric Co., Ltd., 200, Upper Thames Street, London, E.C.—Illustrated revised price list relating to their Sterling "permitted exploders" for shot-firing in coal mines, quarries, &c.

The Metallic Seamless Tube Co., Ltd., "Meta" House, Corporation Street, Birmingham.—Postal card showing, and giving prices of, "Meta" electric irons.

Messrs. Siemens Bros. Dynamo Works, Ltd., 38 and 39, Upper Thames Street, London, E.C.—Twelve-page list containing full technical description, illustrations, prices, &c., of their new double enclosed flame arc lamps for A.C. for the lighting of large areas, such as streets, docks, or works.

Edmundson's Showrooms. — The showrooms of Edmundson's Electricity Corporation, Ltd., in Tothill Street, Westminster, form a good example of what can be done by the actual suppliers of electrical energy to popularise the use of electricity. We understand that practically every reliable device for heating and cooking is on view, and can be demonstrated on circuit to customers, while lamps, fittings and glassware for electric light installations are shown in great variety. In the cooking section there are various types of electric ovens. The individual electric kettle, with detachable heating element, is shown in several styles, whilst electric irons of various weights may be seen and handled. There is a fine selection of radiators on view, embodying practically every available design of luminous, hot bar and convector types, a specially cheap radiator known as the "Edmund," being on sale at a very low price, proving that the production of electrical apparatus is being cheapened. An interesting part of the display at the present time is the collection of fittings and shades, from the purely

Edmundson's Showroom.

decorative type with silk shades, to the more modern varieties in which beauty and efficiency are combined by the use of Holophane glassware. Many examples of this are shown in a special window display which has recently been arranged. Holophane reflectors are shown, with a card demonstrating their efficiency, stating the reflected candle-power given at various angles. In addition, a 10-in. reflector and a bank unit direct their light directly into the eyes of the passer-by, demonstrating both light intensification and effective direction. A number of "Household" types of Holophane are also shown, as well as the new Holophane inverted fitting, with a 100-C.P. "Wotan" lamp. Another item of interest is a semi-direct lighting unit which has a Ceonix bowl, an opalescent glass richly marked in amber, giving, when lighted, a delicate rose tint to the lighting. This set has a high lighting efficiency, as the bowl reflects a large proportion of the light, and is accurately shaped to ensure even distribution. There is also a show of "Wotan" and tantalum drawn-wire lamps, which is made all the more effective by an illuminated tower lent by Messrs. Siemens Bros. Dynamo Works, Ltd., Dalston, which demonstrates the complete range of "Wotan" lamps in bell-shaped bulbs, from ½ to 100 C.P. We reproduce a photograph of the interior of the showroom.

Trade Announcements.—The Baldwin Engineering Supply Co., Ltd., have opened offices and stores at 39, Victoria Street, Westminster, for the supply from stock of electrical accessories, wires, carbons, conduits and fittings, &c.

The Liverpool Fittings Co. have recently fitted up and opened a showroom at 55, Renshaw Street, Liverpool, for the sale of electric light fittings, heating and cooking apparatus, Holophane glassware, vacuum cleaners, &c.

Messrs. Julius Sax & Co., Ltd., of 24A, High Street, New Oxford Street, London, W.C., announce that their telephone numbers are now Regent 2101 and 2102.

Bankruptcy Proceedings.—W. Longdon and V. G. Cobb (trading as Longdon & Cobb), electrical engineers, 101A, Derby Road, Nottingham. The first meeting of creditors herein was held at the Official Receiver's office, 4, Castle Place, Park Street, Nottingham, last week, when the statement of affairs showed liabilities amounting to £291, and assets estimated at £45, leaving a deficiency of £246. The failure was attributed by the debtors to want of capital and bad debts. It appeared that the debtors started trading in partnership towards the latter end of March, 1912, at the above address. Their capital consisted of stock and book debts and other assets of the business formerly conducted by Longdon, which were valued at about £350, less outstanding debts, about £300, leaving a surplus of £50 to be credited to Longdon as his share of the capital. The debtor, Cobb, put in a capital of £150 in cash, and a sum of £30 cash was put in by a relative of Cobb. The drawings of the partners were to be 40s. and 30s. a week respectively for the first 12 months, and afterwards an equal share of the profits. Until February, 1908, the debtor, Longdon, worked as a journeyman electrical engineer, but at that date he started trading on his own account in Cromwell Street. He removed three months later to 101A, Derby Road. A private meeting of the creditors was held in November, but negotiations for the payment of a composition fell through, as the debtors were unable to find the necessary security. Several creditors questioned the debtors regarding the disposal of furniture and effects, and the meeting then terminated.

Charles Spencer Northcote, electrical engineer, 67, Stanthorpe Road, Streatham, London.—Receiving order made December 10th, on a creditor's petition. First meeting of creditors February 19th, at 132, York Road, Westminster Bridge Road, S.E. Public examination February 27th, at Court House, Wandsworth.

For Sale.—The Aberdeen Royal Asylum has for disposal two Crossley gas engines, Dowson gas-producing plant, and two dynamos. The Sunderland Corporation has for disposal a quantity of steam-driven generating plant. See our advertisement pages in this issue.

Dissolutions and Liquidations.—Provincial Electrical Co., Ltd.—This company is winding up voluntarily, with Mr. T. B. Scattergood, Edmund Street, Birmingham, as liquidator. A meeting of creditors is called for February 11th.

Electrolytic Apparatus Syndicate, Ltd.—A meeting will be held on March 10th, at 34, Norfolk Street, Strand, W.C., to hear an account of the winding up from the liquidator, Mr. W. Renison.

Lumb Electrical Bleaching Co., Ltd.—A meeting is called for March 18th, at Prudential Buildings, Queen Street, Nottingham, to hear an account of the winding up from the liquidator, Mr. W. B. Winnicott.

LIGHTING and POWER NOTES.

Atherton (Lancs.).—The B. of T. has formally approved of the placing of overhead lines for the supply of electrical lighting to various large residences in the Westhoughton district.

Australia.—The W.A. Government having bought the Perth tramways, and the City Council having purchased the Electric Lighting Co.'s undertaking, an agreement has now been arrived at for establishing a Government power plant for both purposes. A 9,000-KW. plant for three-phase generation is proposed, at a cost of £162,000; working independently, a new tramway station would cost £100,000, and a new electric lighting station £132,000. A report on this scheme is being prepared by Mr. C. H. Merz and Mr. Wilson.

Balderton (near Newark).—The Parish Council of the village (population, 2,824) proposed to proceed with a scheme to light the streets with electricity from a supply provided by Messrs. Simpson, Ltd., ironfounders. This was last March, and the electors sanctioned an expenditure of £650. Meantime, the price of trade materials has gone up 25 per cent., and the Council proposed to substitute aluminium for copper wire, and wooden standards for steel, in order to effect a saving. A parish meeting was then demanded by a requisition of ratepayers, and a resolution protesting against the Council's action in altering the original scheme, was passed last week. The L.G.B. has written stating that it will raise no objection to the altered proposals. It now remains to be seen whether the Parish Council will carry out the scheme before the election is held in March.

Bath.—At the meeting of the Surveying Committee on Monday, the Street Lighting Committee submitted three schemes for the further conversion of gas lamps to electric lighting, and it was decided to carry out one scheme, costing £140 immediately, and to provide in the estimates for the others, costing £127 and £94 respectively.

Birmingham.—The B. of T. has made an order for cesser of powers of the Shropshire, Worcestershire and Staffordshire Electric Power Co. as to the part of the area which has been included in the enlarged Birmingham city area. The portions include Handsworth U.D., Yardley R.D., and a portion of the U.D. of King's Norton and Northfield.

Bolton.—The Electricity Committee has received applications for supplies of electric current to the following mills:—Messrs. Slater & Co., Little Bolton Bleachworks; Messrs. R. Entwistle & Co., Lincoln Mill; the Victoria Mill, Nelson Street; and Messrs. Winder & McKean, Bradford Mill.

Burton-on-Trent.—A sub-committee has been appointed to prepare and bring up a final report as to the establishment of an electricity showroom.

Canada.—The preliminary report of the Hydro-Electric Commission for the working during 1912, shows a total revenue of $511,801.88, and expenditure amounting to $456,635.43; the surplus has been set aside as depreciation reserve. The loads during the quarters of the year were: 43,149 H.P., 58,326 H.P., 64,306 H.P., and 80,723 H.P. The total capital expended was $4,158,824, including $2,256,129 on transmission lines, $1,322,806 on transformer stations, $542,088 for right-of-way, and $37,803 on distributing stations.

Continental Notes.—GERMANY.—The Kreis Council of St. Goar has empowered the Committee to sign a contract with the A.E.G. for the electric lighting of the whole district. Extensive enlargements of the power station at the State salt mines at Bleichrode are to be carried out, and the Prussian Budget disbursements include a fresh instalment of £10,000 for the purpose. The power station at Memel, which is the property of the Memel Light Railway Co., is to be converted into a bulk supply station, with a view to supplying light and power to the whole of the district, including the City of Memel. A high-pressure network is to be installed.—*Elektrotechnische Nachrichten.*

NORWAY.—The Norwegian Government has raised a loan of 365,000 krone for the improvement of the Port of Narvik; among the improvement works contemplated is the erection of a power station. The occasion affords opportunities for the supply of electrical material, including probably electric cranes, &c.

It is proposed to build a hydro-electric station with a capacity of over 200,000 H.P., which will be worked by the State, and will supply current to Christiania and Western Norway. The station, which will be situated in Numedal and will utilise the Nore Falls, 420 metres high, will be equipped with 11 20,000-H.P. and two 10,000-H.P. turbines. The current will be employed to work the railways, in the first place, and for lighting, &c.—*Journal Pratique de l'Electricité.*

Darwen.—Speaking at a meeting last week, Councillor Jepson said that during the year to meet increased local electricity demands, new plant had been installed at the works. A large number of consumers had been connected requiring current chiefly for power purposes, and the inquiries were coming in freely. New consumers connected during the year would mean an increase in units sold of 1,150,000 units per annum, and the output for power purposes had been trebled during the last 12 months.

The Darwen Spinning Co. has made application to the Corporation for a supply of electricity for motive power.

Derby.—Considerable discussion took place at a meeting of the T.C. on a request of the E.L. Committee for a grant of £13,500 for the purchase of certain plant required in connection with the rearrangement of the electric power station. The Committee proposed to scrap two small machines of 200 KW. and install one that would bring the capacity up to 7,450 KW. It was anticipated that the new machinery, after allowing £800 for interest and sinking fund, would effect a saving of £2,000 per annum. Councillor Green characterised it as only half a scheme at the best, and the works as a white elephant. The site was unsuitable. Any private firm could compete with the Corporation in making electricity, and he himself was beating it in the prime cost of production. Aldermen Hart and Fisher both condemned the idea of raising the money required by means of a loan. The former pointed out that the outstanding debt on the undertaking was £230,000, of which £50,000 was in respect of machinery. The Council rejected amendments directed against the suggestion to obtain a loan for the plant. The Committee's recommendations were approved, and the question was referred to it of the best means of dealing with the money.

Dundee.—The new sub-station at Larch Street will be in operation in a few days, and the excavations on the site for Carolina Port main generating station extension are well in hand, and pile driving will be started immediately.

East Sussex.—The C.C. has decided to oppose the Bills of the Mid-Sussex Electric Light Co. and the Crowborough District Gas and Electric Light Co.

Epsom.—The U.D.C. has agreed to supply current to the B. of G. for the workhouse buildings at 1d. per KW.-hour for power, with a minimum quarterly consumption of 3,000 units, and $\frac{3}{4}$d. per KW.-hour for all over 12,000 KW.-hr. per annum; for lighting, a flat rate of 3d. on a guaranteed annual consumption of 10,000 units, will be charged.

Galashiels.—A Committee of the T.C. has had a meeting with a deputation of manufacturers interested in the introduction of electricity for power purposes. The question of the T.C. taking up the matter, or consenting to the installation being undertaken by a local company, was discussed. The whole question was remitted to a Special Committee for further consideration.

Gillingham (Kent).—The T.C. has decided to give a supply of current to the proposed new cement works to be established in the town at ·625d. per KW.-hour for the first million KW.-hr. per annum and ·6d. per KW.-hour beyond; the amount of energy to be supplied is to be not less than 2½ million KW.-hours per annum, and the contract is to be for five years. The new cement works are being erected by Mr. J. R. Featherby.

Grimsby.—We have received from Mr. W. A. Vignoles, the borough electrical engineer, a copy of the second edition of his "Electricity Consumers' Guide," an 18-page booklet in five sections, giving such information as the inquiring consumer may want, bearing on systems of charging, probable cost, wiring, suggestions for lighting, heating, cooking, &c. We congratulate the author on paragraph 16, which reads, "Great care should be taken to get rid of old gas pipes . . . . this will entirely prevent any chance of a leakage of gas occurring."

Harrogate.—The T.C., on Monday, decided to apply to the L.G.B. for a loan of £6,250 for extensions to the electricity plant.

Hastings.—The manager of the Gas Co. having disputed the alleged saving of £91 during 1912 by the substitution of electric light for gas at the Hastings Workhouse, the chairman of the Electricity Committee was questioned at a meeting of the Corporation. He said the profit to the ratepayers by laying the mains to the workhouse was at present not less than £140 a year, that in five years' time, when the Guardians have paid off their loan for installation, the net saving to the ratepayers will be at least £230 a year.

Hove.—According to the *Express*, the voting in connection with the Bill for acquiring the local electricity undertaking resulted in 1,384 for and 1,015 against proceeding with the matter.

Kendal.—The Electricity Committee has decided that the manager be instructed to prepare an estimate for the installation and fittings for street lighting in the borough.

Kettering.—The Management Committee of the Kettering and District General Hospital has decided to have the electric light installed at the institution at a cost of about £200.

Liverpool.—The report submitted by Mr. Harold Dickinson, city electrical engineer, at the meeting of the Corporation, on January 5th, states that during the past year the reconstruction of the Lister Drive No. 1 station, consequent on the replacement of the high-speed engines by turbines, had made fairly satisfactory process, and during the latter part of the year two sets of direct current turbo-generators, each of 2,000-KW. capacity (British Westinghouse), and one 3,500-KW. turbo-alternator set (British Thomson-Houston) had been put into commercial service. The remaining 3,500-KW. turbo-alternator on order would shortly be delivered, thereby increasing the capacity of No. 1 station from 8,000 to 11,000 KW. Dealing with the second portion of the reconstruction scheme, involving increased boiler plant to deal with the increased size of generating units, Mr. Dickinson advocated water-tube boilers, and said it would be possible to lay down four generating sets of 5,000 to 6,000-KW. capacity each, instead of two of 3,500-KW. each, and by this means postpone the necessity for erecting a new power station. The estimates included the displacement of two batteries of Lancashire boilers (seven boilers to each), which would cover half the reconstruction scheme; but the Committee would probably prefer to commence with only one battery, which would provide ample steam for 1913 for the No. 1 station, the cost being approximately £24,500. With the provision suggested, there would be ample capacity of plant to provide for the load during 1913; but further generating plant should be provided of 5,000 to 6,000 KW. capacity for the winter of 1914, and in view of the long period taken by the contractors for delivery, he considered that the order should be placed for the plant as early as possible. Regarding Pumpfields Station, which was being run less efficiently, Mr. Dickinson recommended that transforming plant supplied with high-tension energy from Lister Drive, should be installed, which would enable Pumpfields to be shut down for the greater part of the year.

The annual accounts of the electricity department show a total revenue for the year ended December 31st last of £285,803, and a balance carried to net revenue account of £169,292, which, with interest accrued, amounted to £172,363. Interest and sinking fund absorbed £65,615 and £55,628 respectively; £1,048 was transferred to reserve and £20,000 to renewals, and the balance of £30,071 was contributed to the general rate. The reserve fund amounts to £178,508, and the unexpended balance of the renewals fund to £120,000. The outstanding capital expenditure amounts to £1,560,000.

London.—WESTMINSTER.—The Works Committee reports having had under consideration the question of the Council's contract with the Charing Cross Electricity Supply Co., for lighting the parish of St. Martin-in-the-Fields, under which the Council has the option to determine the contract at the end of the fourteenth year of the contract, viz., on September 17th next, provided notice be given on or before March 17th; and if the option is not exercised the contract will run for the full period of 21 years. The Committee states that the termination of the contract in the fourteenth year would, by Clause 14 of the contract, entail the purchase by the Council of lamps, fittings, conduits, mains, service lines and all other apparatus then in use, but not distributing mains used for general supply. 124 lamps are lighted and maintained by the company under the contract, and the payment per lamp is as to 101 lamps, £28 per annum, and as to 23 lamps, £27 10s. per annum, these rates being inclusive of all capital charges, except for the columns, which are the property of the Council. The price now paid by the Council for lighting and maintaining (exclusive of capital charges), 1,800-C.P. gas lamps is £15 10s. per lamp per annum, and for 3,000-C.P. gas lamps £22 per lamp per annum, under a five years' contract. The company has offered to improve the lighting of the area by substituting flame arc lamps, provided the Council contributes one-half of the cost, estimated at £1,488. The purchase price for the property is £10,726, and the company has been asked to furnish further details of this price. Concluding, the Committee states that before considering further, it has directed that competitive tenders for the public lighting of the streets now lighted under the contract be invited

from the electric light companies having powers of supply in those streets, and from the Gas Light and Coke Co.

Lewisham.—The B. of G., on Monday, decided to install the electric light at the infirmary in place of the present gas. A report of a special Committee, stated that experimental lighting of certain wards by the South Metropolitan Gas Co., and the South Metropolitan Electric Light and Power Co., had resulted in its coming to the unanimous opinion that the electric light was far preferable upon the grounds of better lighting, cleanliness, healthiness and general convenience. During last year, £83 had been expended in the infirmary on mantles, burners, globes, &c. The present system of lighting by gas necessitated the whole of the wards, rooms and offices being whitewashed every year, and the wages alone paid to labourers for this work amounted to £160 odd. The chairman of the Sub-Committee, in his observations on the subject, said that in the wards lighted by gas the lights were turned on by means of switches attached to the walls, and worked similarly to the electric switches. This plan seemed at first to be a very excellent one, but in practice they were very disappointing, and probably a source of danger, for it was found that often when the light was switched on, or supposed to be switched on, all that happened was an escape of gas and no light, owing to the by-pass having gone out. On one occasion no less than 15 lights were out. This was, no doubt, owing in a great measure to the draughts which were unavoidable in such institutions. The system was an untried one in large institutions, and has the disadvantage that the light must be full on or not at all. The cost of the electric current, though a little more than gas, compared favourably. The chairman pointed out that the system of gas lighting tried was the best the gas experts could suggest. A test was made under equal conditions, lasting just three hours, the number of lights in each case being 24. The cost of the gas was at the price at present charged, and the electric current was 3d. a unit. The cost of gas used in three hours was 5·2d., and that of the electricity was 5·55d., a difference of ·35d. It might be questioned if this could be correct. It was true that the gas company had stated it was prepared to quote special terms for gas, but had made no definite offer. The Board had also to consider the cost of mantles, which last year was over £83. The cost of installing electric light would be £800. The question of lighting the workhouse by electricity was adjourned to the next meeting.

Battersea.—The electrical engineer advises a further extension of plant at the central generating station in order to cope with next winter's demand. Accordingly, an additional boiler with mechanical stoker, pipework, gearing, &c., and a condenser circulating water pump is to be provided at an approximate cost of £3,275, and tenders are to be invited therefor.

Manchester.—On behalf of the ratepayers in Cavendish Street and Stretford Road—two important shopping thoroughfares—representations have been made to the Lighting Committee of the Corporation in reference to a better method of lighting such thoroughfares by means of an electric installation, and the Committee has instructed Messrs. Newbigging & Pearce to prepare and submit a joint report on the subject of the public lighting of roads, streets, courts and passages in the city.

A section of the central area was deprived of electricity from about 9.30 to 11 o'clock last Friday night. Two of the principal newspaper offices were affected. According to an official statement by Mr. S. L. Pearce, the chief engineer, made on Saturday, the fault occurred on only one of the 16 sections into which the whole of the central area is divided. Apart from the two newspaper offices, not a single inquiry was received from any consumer until an hour after the trouble arose. Mr. Pearce stated that the division of the area was made about eight years ago, and Friday's occurrence had shown how wise the policy was.

Nelson.—A Sub-committee of the Electricity Committee has interviewed representatives of four firms of cotton manufacturers on the question of a supply of current from the Corporation mains for loom-driving. The firms in question would be prepared, subject to satisfactory tests, to accept the terms offered by the Committee. What the terms were did not transpire, and Mr. Dinsdale said the proposed step was so important that if he were chairman of the Committee he would not like to accept the responsibility of letting it go through without open discussion. The chairman replied that the Committee was unanimous, and the only question at issue was one of price. Applications had been received in respect of 1,760 looms, and it was essential to get the business through without delay.

An inquiry was held on the 6th inst. by the L.G.B. relative to the proposal to borrow £2,000 for electricity purposes. No opposition was raised.

Newport (Mon.).—In connection with the report which is being prepared by the electrical engineer upon the subject of the extension of the generating plant, the different types of plant in operation in other parts of the country are to be inspected. The engineer has submitted a scheme for the improvement of the lighting of Caerleon Road. This scheme provides for 14 500-c.p. lamps, each consisting of five 100-c.p. lamps, and showed that the annual revenue, if the same amount were paid as for existing arc lamps, viz., £16 per lamp, would be £224. The lighting would be done from overhead wires, and the tramway standards would be utilised instead of erecting lamp columns. The gas company also submitted a scheme for improving the gas lighting of the portion of Caerleon Road in question, using the "Parkinson lamp" with twin inverted burners, which, if adopted, would make the approximate cost £65 per annum, as against £42 for the existing gas lamps. The cost of the lanterns would be £2 3s. for each lamp. The Electricity Committee has instructed the engineer to provide a series of four electric lamps, and asked the Gas Co. to demonstrate with four of the improved type of gas lamps suggested by it.

Orsett.—The L.G.B. has intimated to the B. of G. that, speaking generally, it is not disposed to approve of the installation of plant for the production of current for lighting the Workhouse buildings. The Guardians, however, have decided to reply that the Workhouse is isolated from any large town, that there are no means of obtaining electricity without it being generated on the premises, and that they believe that electricity is the cheapest and best system of lighting.

Oulton Broad.—The U.D.C. has, by 8 votes to 4, declined an offer to purchase the undertaking of the Electric Lighting Co. for £2,000; £1,100 for inside and outside plant, meters, goodwill, &c., and £900 for outside mains, meters, goodwill, &c.

Peterborough.—The T.C. has received the sanction of the L.G.B., to a loan of £1,000 for mains.

Rochdale.—In December last the Corporation sought the sanction of the L.G.B. to loans of £15,000 and £30,000 for extensions at the electricity works. On Wednesday, last week, the Gas and Electric Committee decided to ask the L.G.B. to sanction the borrowing of an additional £30,000 for extensions to the building, and boiler and general plant. The necessity for the extension is urgent, and the Committee decided to advertise for tenders straightaway, in order that no time should be lost.

Rotherham.—The electrical engineer has been instructed to report upon the question of providing additional generating plant. Sketch plans have been approved for extending the tram-car sheds in Rawmarsh Road.

St. Helens.—The L.G.B. has forwarded to the T.C. sanction to a loan of £3,873 for excess expenditure on mains, £1,133 for similar expenditure on services, rotary converters, boilers, &c., £500 for sub-station buildings, £3,800 for cables, £600 for sub-station equipment, and £1,900 for transformers.

Salford.—Improvements which are being effected at Salford Docks, include the installation of six electric cranes to lift 2 tons. One of the new cranes was tested last week. The order has been given to Messrs. Higginbottom & Mannock, who are also supplying eight 30-cwt. electric cranes for No. 8 Dock.

Sheffield.—The Electric Lighting Committee recommends the T.C. to apply to the L.G.B., for a loan of £130,860 for extensions. The sum includes £62,800 for buildings, &c., and £58,800 for boilers, pipework, turbo-alternators, and switchboard.

Shipley.—Messrs. G. A. White & Co. have asked the U.D.C. to supply current for power to their proposed new shed on the Shipley Fields estate, but the Council has replied that at present it cannot undertake the supply.

South Shields.—Mr. Ellis, the borough electrical engineer, informs us that energy for outside arc lighting will in future be charged 2d. instead of 4d. per kw.-hour, and for domestic power (1½d.) will be charged at the heating and cooking rate of 1d. per kw.-hour. Also that practically the whole of the street lighting has been brought up-to-date, by the adoption of 12-ampere Exello arcs in place of the 94 old type arcs—four 12-ampere Metro-flam magazine lamps being also in use at points distant from the arc lamp routes, in order to save attendance costs; 475 incandescent lamps have been fitted with 32 instead of 16-c.p. metal lamps, and in a number of other cases 50-c.p. metal lamps have superseded 32-c.p. lamps. The headquarters of the electricity department will shortly be removed to new offices directly opposite the municipal buildings, and a showroom will be provided there.

Stockport.—Mr. J. Welsh, speaking at the T.C. meeting on February 5th, drew attention to the decision of the Electricity Committee to supply electricity at a flat rate of 1½d. per kw.-hour, less 5 per cent. for lighting and power purposes, and expressed the hope that the question of reducing the general price for electric lighting (3½d.) to the ordinary consumers would receive consideration. Alderman Hopkins said he hoped the Committee would consider the question of giving special treatment to seven-day consumers of electricity, to those people who used electricity all the year round. Alderman Ball (chairman of the Electric Committee) said the questions raised would be considered in March. He agreed that people who used electricity for long hours, seven days of the week, were entitled to consideration.

Stoke-on-Trent.—The T.C. is considering the advisability of having the Market at Tunstall lighted by electricity. The estimated capital cost of the scheme is £550, and the annual cost of lighting and upkeep about £150.

Tasmania.—The City of Hobart is now lighted by electricity, supplied from a temporary steam station pending the completion of the hydro-electric company's scheme; gas lighting having been superseded.

Tunbridge Wells.—The Corporation has referred the report of the borough electrical engineer with respect to the replacement of the small generating sets, to its consulting engineers, Messrs. Horace Boot and Partners.

Walsall.—The position of the Corporation's electricity undertaking is causing grave anxiety at the present time, and the matter was discussed at Monday's meeting of the T.C. The loss on the concern last year amounted to no less than £3,853. The reserve fund is only £1,594, and assuming this amount is utilised for the reduction of the deficit, it still leaves considerably over £2,000 to come out of the pockets of the ratepayers. Recently the Council appointed a Committee to thoroughly investigate the position of the undertaking and to report as to the best means of placing it upon a sound footing. It was then found that, for some time, the department had been completely disorganised, owing to alterations, extensions, repairs, &c. The Committee also found that the plant was working altogether inefficiently, that the fuel consumed was inferior, and that, generally speaking, the coal strike had had a great deal to do with the unsatisfactory working. In order to maintain supplies, fuel had to be purchased at an increased price, whilst the inefficient working of the plant was attributable to the fact that there had been delay in completing the alternating-current plant and making it ready for use. Furthermore, it was discovered that, as a result of the reduction in price of current for traction purposes, there had been a decrease in revenue of over £800. The outcome of the whole matter is that, at Monday's meeting of the Council, the members were recommended to call in an electrical and mechanical expert to report fully upon the undertaking. They were also recommended to take into consideration the advisability of increasing the price of electric current. After receiving the report of the consulting engineer, the recommendations were adopted by the Council.

Warwickshire.—The C.C. has decided to oppose the Bill of the Coventry T.C. for powers to supply electricity in the parishes of Ellesley, Binley, Coundon, Keresley, Stoneleigh, Walsgrave-on-Sowe, Willenhall and Wyken.

Wolverhampton.—The following figures show the growth of the Corporation's electricity works during the past three years:—The output has increased from 7,072,114 units to 11,544,636 units; the capacity of the additional generating plant installed amounts to 3,500 KW.; the station costs have decreased from ·476d. per unit to ·345d. per unit; the gross profit has increased from £16,891 to £24,042; and the net profit has increased from £3,401 to £7,079.

York.—The recommendation of the Electricity Committee to extend the electricity works and plant, at a cost of £30,000, has been confirmed by the City Council. It was stated, in reply to critics who complained that Messrs. Rowntree were favoured with special terms, and that the extension was needed for the latter's convenience, that the firm took more electricity than all the other consumers, including the tramways, put together, and that they were prepared to take another 750 KW. per annum with a guarantee. They had had a contract for a year, the result being that the undertaking was £3,000 better off than in the previous year.

TRAMWAY and RAILWAY NOTES.

Abertillery.—The U.D.C. has decided to oppose in Parliament the Western Valleys (Monmouthshire) Railless Electric Traction Bill.

Australia.—The Cabinet has approved the underground electric railway project for Sydney (N.S.W.), and the work is to be started immediately.

Batley.—A deputation from the Dewsbury Electricity and Tramways Committee is to meet a Committee of the Corporation, on the 20th inst., to discuss the question of the proposed line of tramways to Staincliffe.

Bolton.—The new Corporation tramways repair sheds were opened on February 5th by the chairman of the Tramways Committee. The works include the following departments: Wheel and truck shop, fitted with an overhead travelling crane capable of lifting 7½ tons, a wheel lathe, wheel press, and two hydraulic jacks; electrical repair shop, with pits over the whole area; paint shop; body shop, with basement for the suction pipes to the pneumatic dust-removing installation; turning and fitting shops, with an overhead runway and trolley tracks; smithy, offices, &c. A traverser has been laid down to serve the wheel and truck, electrical, paint and body shops, and an overhead runway and trolley tracks have been laid along the main passages. The whole of the machinery is electrically driven. Dining, billiard and club rooms have been provided for the staff. The work has been carried out under the superintendence of the borough engineer. In opening the building, Alderman Miles mentioned that the estimated cost was £20,000.

Royton and Crompton.—Subject to the approval of the B. of T., the Oldham T.C. has agreed to lease the tramways in the urban areas at Royton and Crompton for 21 years. Oldham will pay Royton U.D.C. a rental of £3,677 per annum and Crompton U.D.C., £1,294 a year.

Bradford.—The tramway tracks in several sections of the system are to be renewed, at an estimated cost of £21,836. This sum includes the doubling of the track at Great Horton, for which the sanction of the Board of Trade is to be obtained. Tenders are to be invited for carrying out the foregoing work, including the provision of steel poles for the equipment of trolley vehicle routes.

Bournemouth.—The T.C. has confirmed a proposal to introduce a Sunday service of tramcars, from 2.0 to 10 p.m., and to pay the employés engaged on such work at the rate of time and a quarter.

Brighton Railway Electrification.—Speaking on the advantages of electrical working on the Brighton Co.'s suburban railways, Lord Bessborough, chairman of the company, at the recent general meeting, said: Prior to the establishment of electrical services there were 496 trains working in and out of Victoria Station in the day. At the present time 739 trains a day were worked. At London Bridge the steam trains working in and out prior to electrification numbered 663 a day, but now 901 trains a day passed in and out. The average number of passengers carried each year on the South London line since electrification was over 4½ millions more than the number carried in the last year of steam working, or 14,000,000 more passengers during the whole period. The Victoria and Crystal Palace electrical services began 18 months ago, and in that period there had been an increase of nearly 4,000,000 passengers. The London Bridge and Crystal Palace services had been in operation for six months, but even in that time they had obtained an increase on this section of over 319,000 passengers. The cost of the maintenance of the whole of the overhead equipment, since it was first erected, had been £2,927, which worked out at the low figure of £21 per mile per annum, and the other conditions of maintenance were equally satisfactory. He went on to refer to the company's decision to extend the electrical working to the greater portion of its remaining suburban lines, particulars of which were given on page 176, and stated that the contracts will shortly be made with the Metropolitan Carriage Co., for the motor coaches, and with Messrs. Blackwell, for the overhead construction. The works will take four years to complete, but it is anticipated that an important part will be in use within 18 months.

Bristol.—It has been decided to request the Tramways Co. to remove the centre tramway poles between Bath Bridge and St. Augustine's Bridge, on the ground that they constitute an obstruction to traffic in their present positions. The cost of carrying out the work is put at £1,700.

Continental Notes.—GERMANY.—In connection with the projected electrification of the Berlin municipal and suburban railways, 26 members of the Budget Commission of the Prussian House of Deputies recently made a visit of inspection to the Bitterfield-Dessau electric railway and the power station at Muldenstein, which is undergoing enlargement for the purposes of the projected electrification.—*Elektrotechnische Nachrichten.*

RUSSIA.—The town of St. Petersburg proposes to issue a £7,000,000 loan, half this amount being required for electric tramway extensions in the city.

Croydon.—The Tramways Committee recommended the B.C. on Monday to seek powers to extend the Addiscombe tramway to South Norwood, *via* Woodside, at an estimated cost of £28,102. The scheme provided for a double track over nearly the whole route, and for the purchase of five cars. Powers were obtained for this extension in 1905, but were allowed to lapse. The chairman of the Committee contended that the great growth of the neighbourhood justified the expansion, which would follow the principle adopted by the L.C.C. of linking up various dead ends. Addiscombe was their best paying route, and he was sure of further profit. The widespread talk about motor-'buses being about to "wipe out" tramcars he attributed to party motives in connection with the L.C.C. elections. All the information that he had pointed to tramcars being run more cheaply than motor-'buses, even if the price of petrol came down by two-thirds. However, it would take two or three years to carry out the scheme if adopted. If, in the meantime, motor-'buses came over the route—and he believed there would not be enough traffic to maintain both services—the Council could reconsider the position. Councillor Hussey moved the reference back. Strong fears of motor-'bus competition were expressed by several members, and one described the chairman's attitude as a direct invitation to motor-'bus companies. Councillor Umney advocated railless traction, estimating that the cost would not be more than £10,000. The voting was a tie of 24 votes on each side, and the Mayor (Councillor S. Rogers) gave his casting vote for the reference back.

Dewsbury.—The General Purposes Committee of the Corporation has recommended that the Parliamentary Committee apply for a prov. order for powers to construct a tramway from the present terminus of the Dewsbury and Ossett tramways across the Market, and a junction with the Spen Valley Light Railway, with running powers over the respective lines, for the purpose of linking up the proposed Shaw Cross and Westborough tramways. It was also decided that, subject to the approval of the Batley Corporation, powers should be obtained for carrying the Westborough tramway system from the borough boundary at Dewsbury Moor to Staincliffe.

Doncaster.—The Rural District Council has decided to oppose the Mexboro' and Swinton Tramways Bill, which is to provide for the establishment of a railless traction system, the ground of objection being that the cars are injurious to roads.

Folkestone.—The T.C. has sealed a petition against the Folkestone and District Railless Traction Bill. A similar course has been taken by the neighbouring Urban Councils at Cheriton and Sandgate.

Glasgow.—At an early date the T.C. will be asked to consider a recommendation by the Statute Labour Committee for the erection of a new bridge—making four in all—over the River Clyde, in the centre of the city. For years back, since the inauguration of the trolley-car system, in fact, the congestion on the main thoroughfares has become very marked, and is yearly increasing through the lengthening of car routes and the augmentation in the number of cars. The proposed bridge, if the Committee's recommendation is approved, will be immediately to the west of the present Jamaica Bridge, over which the heaviest of the north and south traffic passes, and will be utilised as a relief to several of the routes converging near that point. The convener of the tramways, in a recent speech, promised a handsome contribution, if not the whole cost of a relief bridge, if such a structure was erected to the satisfaction of his committee.

Hastings.—On Friday the Corporation passed formal resolutions adopting a petition to Parliament in opposition to the Hastings Tramways Bill which is being promoted in Parliament, and authorising the expenditure of the necessary money for opposing the measure. The object of the promoters of the Bill is the substitu-tion of overhead wires along the entire front of the town and Robertson Street (the chief business thoroughfare) for the existing Dolter system, which has for some time past been considered unsatisfactory. At the instance of the Corporation, a B. of T. Inspector has been down and made certain suggestions to the company. Frontagers are practically unanimous against overhead wires, which they contend would effectually ruin the Front line. The resolutions to oppose were carried by 30 votes to 5.

London.—HACKNEY.—The Woolwich B.C. has been informed that the Hackney Council will co-operate with it and with the Lewisham B.C. in opposing the L.C.C. Bill so far as it has reference to running railless trolley vehicles.

Manchester.—The Tramways Committee has decided to construct a double track along Slade Lane, Levenshulme, a growing suburban district. The Tramways Committee is also in the market for a number of motor-'buses.

Midland Railway Electrification.—According to the *Daily News*, the Midland Railway Co., since the acquisition of the Southend and Tilbury line, with joint use of Fenchurch Street Station, has taken up consideration of the development of its London suburban traffic. The company is bound by the Act permitting the taking-over of the Tilbury and Southend line to equip the latter for electric working within seven years. The first step in this direction will be the extension of the present electric train service from Barking to Upminster and the running of through electric trains to that point from the underground system. Consequent on this alteration the company now contemplates the electrification of the line formerly known as the Tottenham and Forest Gate Railway, running from Kentish Town to East Ham, where the main line between Tilbury and London is joined. The main line from Kentish Town to St. Pancras will also be equipped for electric working. At the same time it is proposed that the line to St. Albans, passing through Mill Hill, shall also be electrified, and a junction made with the extended Golder's Green tube at Colin Dale, just beyond Hendon.

Newport (Mon.).—On various grounds the T.C. will oppose the Western Valleys Railless Electric Traction Bill.

N.-E. Railway Electrification Schemes.—The North-Eastern Railway Co. is about to electrify the section of line from Shildon, in Durham, to Middlesbrough-on-the-Tees, a distance between 18 and 20 miles, and embracing 50 miles of track. Energy will be supplied by the Newcastle-on-Tyne Electric Supply Co., in conjunction with the Cleveland and Durham County Electric Power Co. The contract for the electrical equipment for the first 10 locomotives, which are to be constructed at the N.-E. Railway locomotive works at Darlington, has been placed with Messrs. Siemens Bros. The contracts for the sub-station plant are said to have been placed with the British Thomson-Houston Co., and the cables with the British Insulated and Helsby Cables, Ltd. The line is largely used for mineral traffic, and the trains to Newport average over 900 tons in weight; the reverse traffic consists principally of empty trains of 350 tons weight.

North-Western Railway Electrification.—The new local line between Willesden and Watford was opened for traffic on Monday, with a temporary steam service, pending the carrying-out of the electrical scheme, in connection with which considerable progress is being made. The contract for the power station at Stonebridge Park is about to be let, and the tunnel work in connection with the extension of the Bakerloo tube to Queen's Park has been commenced.

Oxford.—The T.C. has passed a motion authorising the Tramways Committee to make application for the payment of fines and penalties due to the Corporation, by reason of the failure of the National Electric Construction Co. and the City of Oxford Electric Tramways, Ltd., to carry out the electrification of the tramways

Sheffield.—The highways surveyor has been instructed to put in hand the work of doubling the length of single tramway track near Woodbank Crescent on the Woodseats section as early as practicable. The track in Flat Street is to be extended to the bottom of Sycamore Street. Tenders are to be obtained for two negative boosters for the Kelham Island power station, and for 1,000 tons of tramway rails. In connection with the alteration of the road levels at the junction of Spring Vale, Howard Road, and Upperthorpe, part of the tramway track is to be renewed.

South Lancashire.—At a meeting of the Worsley District Council, held on Monday, a plan was submitted by the South Lancs. Tramways Co. for a short length of tramway in Manchester Road, Walkden, connecting with the proposed new tramway through Little Hulton.

South Shields.—At a meeting of the T.C. on the 5th inst., the question of extending the tramways from Laygate to the low entrance to Tyne Dock was dealt with in a report of the Tramways Works Sub-Committee, which, after considering a report from the tramways manager, stated that it was unable to recommend the extension along the route suggested. The Tramways Committee recommended that the Sub-Committee's decision be confirmed. The Mayor, in moving the adoption of the report, said that no undertaking could afford to put down a service for working men only, and he, after making a study of the suggested new route at all times of the day, could testify that it was practically deserted after 5 p.m. Mr. Sykes commented on the importance of tapping the traffic in the Corstorphine district, and moved that the matter be sent back to the Committee for further consideration. Eventually the amendment was negatived, and the report was adopted.

Stockport.—At the T.C. meeting on February 5th, consideration was given to a report made by the tramways manager upon the effect of the alterations of tramway fares. The report showed that, compared with the corresponding period of the preceding year, the aggregate increase of revenue for the period under review was £2,049 on the sections concerned. Alderman Sharples, the chairman of the Tramways Committee, said there was no doubt there had been a loss. Traffic had increased on all sections, but the reduced fares had resulted in a loss. He hoped this circumstance would not be taken as an inducement to reduce fares further without consideration of what the result might be.

Walsall.—The working of the Corporation's tramways for the past year shows a net profit of £3,392, which is to be carried to the reserve fund after a payment of £500 to the borough fund in aid of the rates. The Tramways Committee has also notified the Finance Committee that it is proposed to make a contribution from the estimated profits of the tramway undertaking in relief of the rates for 1913 to the amount of £1,000 (in addition to the £500 mentioned), to be paid in two instalments before December 31st next.

West Hartlepool.—A statement which has just been prepared, for the information of the members of the West Hartlepool T.C., shows that the total capital expenditure by the Corporation on the tramways is £66,943. The arbitration expenses in connection with the Foggy Furze lines amounted to £1,858, of which counsel's fees were £1,124, and expert witnesses £636. The costs of the case in the King's Bench Division regarding the purchase of the same were returned at £112, and in the Court of Appeal £136.

TELEGRAPH and TELEPHONE NOTES

Australia.—A correspondent of the *Times* says that wireless stations are now operating in the six State capitals, as well as on Thursday Island and at Port Moresby.

Hong Kong.—The Government has sanctioned the installation of wireless telegraphy at Hong Kong, and as stations will also be erected at Singapore and in North Borneo, ships equipped with wireless will be able to maintain communication with the land at all points within these limits.

Ice Dangers in the Atlantic.—It is reported that negotiations are passing between the Government and the principal Atlantic steamship lines with a view to stationing in the ice region a vessel which will have a very powerful installation of wireless telegraphy, and will report to stations on the American coast and to Atlantic liners crossing the ocean the positions of icebergs or other dangers to navigation.

Imperial Wireless System.—On Wednesday last week the Select Committee on the Marconi contract further examined Mr. W. R. Lawson, who communicated to the Committee the names of the brokers and dealers most largely concerned with transactions in the company's shares, and discussed methods of identifying the persons for whom they had acted. The witness said there was no doubt that the largest transactions had been foreign. He said that his articles in the *Outlook* and the *National Review* were written at the request of the editors, and that his references to Ministers in the former were not intended to constitute charges against them. He thought some of the expressions he had used were unfortunate.

He held that Mr. Godfrey Isaacs, by reason of his relationship to the Attorney-General, was able to get better terms than other companies, though he did not suggest that the Attorney-General interfered with the negotiations in any way. He had found no definite grounds for making any charges against Ministers.

On the following day Mr. Lawson said that if he were writing the articles again he would not employ the same language in regard to Ministers. He made no effort to find out whether there was any foundation for the rumours connecting Ministers with dealings in the shares, and he agreed that the charges should not have been made without evidence.

On Monday the Hon. W. Guinness, M.P., chief proprietor of the *Outlook*, and the editor of that paper, Mr. E. Oliver, were examined. The former expressed regret if anything in the articles could be taken as suggesting improper financial conduct on the part of Ministers. He considered that certain sentences were very regrettable. He had not the slightest doubt as to the personal honour of the Postmaster-General. Mr. Oliver denied that he ever looked upon the articles as charging Ministers with personal corruption. He thought they were a most valuable series. If he had foreseen the appointment of the Committee, he would not have published the articles.

On Wednesday, the examination of Mr. Oliver was continued and concluded; Mr. L. J. Maxse, editor and proprietor of the *National Review*, was then called, and on his refusal to divulge the names of persons from whom he obtained information regarding the rumours that Ministers were financially interested in the Marconi contract, because it would be a breach of confidence, the Committee resolved to report him to the House of Commons. No further sittings will be held until the next session.

Mr. Godfrey Isaacs addressed a letter to the Secretary of the Post Office, in reply to that of the Postmaster-General, stating that the Marconi Co. felt morally entitled to ask that the agreement should be considered as no longer binding on either party. In addition to the other matters to which he referred in his previous letter, the company had been obliged to reserve, for nearly a year, the sum of £300,000 to enable it to carry out the work. Having taken counsel's opinion, the company was advised that it was now entitled to intimate that, unless the Postmaster-General was in a position to confirm the contract by March 1st next, the company would treat the contract as at an end. The company, however, was reluctant to take this course, and requested further consideration of its letter of January 15th.

Italy.—A scheme has been submitted to the Consigli dei Ministri, for the expenditure of £4,500,000, spread over several years, on the systematisation and extension of the Italian telephone networks. The projected operations comprise the building of many new up-to-date exchanges, great additions to the network in each city, and its entire conversion to the underground system. The automatic and semi-automatic systems are also to be largely introduced.—*Telegrafia e Telefonia.*

Japan.—The negotiations for the purchase by the Government of the submarine cables between Nagasaki and Shanghai, and between Tsuruga and Nagasaki, are reported to have been completed.

Norway.—The Marconi Co. has consented to the prolongation from March 1st to July 1st of the period during which Norway must decide with regard to the proposed contract for the establishment of a wireless service to America.

Suffragist Outrages.—On Friday and Saturday last week, telegraph and telephone wires between Coventry and Birmingham, near Dumbarton, and between Glasgow and London were cut by suffragists, and the underground cables to Glasgow were also put out of order.

The Telephone Transfer.—The Postmaster-General is appealing against the award of the Railway and Canal Commissioners with regard to the cost of raising capital, which was assessed at £247,189, and on minor matters.

Underground Cables.—In reply to a question in Parliament, Mr. H. Samuel stated that the total length of the main underground routes was 1,197 miles in England, and 133 miles in Scotland. The total expenditure under the Post Office votes, and the telephone capital account, had been about £2,100,000. The expenditure on the routes in the two countries had been approximately proportionate to the mileage.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—March 3rd. Service materials, for the U.D.C. electricity department. See "Official Notices" to-day.

Ashton-under-Lyne.—February 19th. H.T. switchgear, water-softening plant, steam, exhaust and feed pipes, tanks, &c., for the Corporation. See "Official Notices" January 31st.

Austria.—Pilsen.—February 24th. Tenders are required for one 30-H.P. three-phase motor with accessories, one 8-H.P. ditto, two electric nut-grinding machines, two portable electric drilling machines for holes up to 50 mm. diameter, two ditto for holes 30 mm. diameter, one portable circular saw with electric drive, one electric polisher, and other machinery. Particulars, forms of tender, &c., K.k. Staatsbehandirektion, Pilsen, Austria.

Australia.—Victoria.—February 21st. Four 1,500-KW. rotary converters, for the Melbourne City Council. See "Official Notices" December 6th.

Western Australia.—February 19th. Armoured telegraph cable, for the P.M.G.'s department. See "Official Notices" January 10th.

February 27th.—Buildings and boiler-house equipment, turbo-alternators and rotary converters, for a Government power station at Perth. See "Official Notices" January 24th.

Sydney.—March 17th. Motors for the City Corporation.

South Australia.—March 5th. One section of a common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" January 31st.

Commonwealth Government.—Darwin power station, about 2,000 KW. Equipment to comprise Diesel oil engines and accessories and overhead travelling crane, alternators and exciters, and switchboard.

New South Wales Government Railways.—March 5th. Twelve single-phase transformers, and one 12½-KW. generator. Specifications 388 and 389 (2s. 6d. each) from Electrical Engineer's Office, 61, Sydney.

Balearic Islands.—February 18th. The municipal authorities of Valldamose are inviting tenders for the concession for the electric lighting of the town during a period of five years.

Belfast.—February 24th. Stores and materials for one or three years, for the City electricity department. See "Official Notices" January 31st.

Bicester.—Electrical installation for the U.D.C. area. See "Official Notices" to-day.

Blackburn.—February 15th. Materials for a year, for the Corporation Electricity Department. See "Official Notices" January 31st.

Bolton.—February 24th. Materials and stores, for the Corporation Tramways Department. See "Official Notices" February 7th.

Bournemouth.—February 20th. Stores for a year, for the Corporation tramway department. Mr. I. Bulfin, General Manager, Lansdowne.

Bradford.—The Chairman and Deputy Chairman of the Corporation Electricity Committee have been authorised to purchase an electrical photo-copying apparatus, for reproduction of plans, &c., at a cost of £60.

Brussels.—February 19th. Tenders are invited for the supply of train lighting material for the State railways, as per Cahier des Charges Spécial No. 758. Particulars, Salle de la Madeleine, Brussels.

February 25th.—Tenders are required for the supply of electric meters required for the public service. Particulars, Maison Communale, Ixelles-les-Bruxelles, Belgium.

Canada.—The Hydro-Electric Power Co. of Ontario, propose shortly to call for tenders for the materials for the construction of 125 miles of double-circuit 110,000-volt transmission line, and the necessary equipment for sub-stations for the transforming of 20,000 H.P. from the line to 13,200 volts. Various types of apparatus will be considered. The tenders will be called for in March. Address, Continental Life Building, Toronto.

Croydon.—February 24th. Sinking artesian well and supply of pump, for the Corporation electricity works. See "Official Notices" to-day.

Darlington.—February 17th. One 1,000-KW. steam turbo-alternator, one 750-KW. and one 250-KW. rotary converter, and one water-tube boiler, for the Corporation. See "Official Notices" January 31st.

Derby.—February 19th. One 2,000-KW. turbo-alternator, for the Corporation. See "Official Notices" February 7th.

Durban (Natal).—February 24th. Corporation Tramways. Supply, f.o.b., of six miles of B.S.S. flat-bottom Vignoles tram rails, together with fish-plates, bolts and nuts, copper bonds and dog spikes. Specifications and forms of tender, £2 2s. returnable, from the agents, Messrs. Webster, Steel & Co., 2, East India Avenue, Leadenhall Street, London, E.C., to whom tenders have to be sent.

Edmonton.—February 26th. Electric lamps for the B. of G. Mr. F. Shelton, clerk, The Grange, White Hart Lane, Tottenham.

Egypt.—March 31st. Section des Municipalités invites tenders for electric light installation at Damietta. For further particulars see this column for January 24th.

Finchley.—February 17th. One 300-B.H.P. oil engine, coupled to a 200-KW. E.C.C. generator, for the U.D.C. See "Official Notices" February 7th.

Gloucester.—Stores for a year, for the Corporation Light Railways Committee. Mr. L. Johnston, General Manager, Bristol Road.

Halifax.—February 17th. Stores and materials for a year, for the Corporation electricity department. See "Official Notices" January 31st.

February 17th.—Stores and materials for tramways department for 12 months. Tramways Engineer, Tramways Office, Skircoat Road.

Hornsey.—February 24th. Electricity meters, cables and cable stores, for the T.C. See "Official Notices" February 7th.

Ilford.—February 25th. Stores for a year, for the U.D.C. electricity department. See "Official Notices" February 7th.

India.—February 18th. High and low-tension switchboards, for the Bombay, Baroda and Central India Railway. See "Official Notices" January 31st.

Leeds.—February 19th. Coal and general stores for a year, for the Corporation electric lighting department. See "Official Notices" January 24th.

February 17th.—The City Tramways Committee invites tenders for electrical sundries and engineers' furnishings, and for the reconstruction of certain portions of tramway track.

London.—Bermondsey.—February 17th. Stores for a year, for the B.C. Electricity Department. See "Official Notices" January 24th.

L.C.C.—February 25th. Electric wiring of the Camberwell and Cressy Road car-sheds. See "Official Notices" January 31st.

February 25th.—Two 8,000-kw. turbo-generators, with condensers, &c., three 1,500-kw. rotary converters, nine transformers for rotary converters, and two starting transformers. See "Official Notices" to-day.

February 26th.—Electrical installation at Leipsic Road Elementary School, Camberwell, S.E. See "Official Notices" to-day.

The Highways Committee is to invite tenders for the supply of 2,200 track insulators and 3,200 porcelains in connection with electrical repairs and renewals of tramway lines, from selected firms.

Fulham.—February 19th. Electrical and engineering stores for a year, for the B.C. See "Official Notices" February 7th.

St. Pancras.—March 4th. Arc lamp carbons, for the B.C. See "Official Notices" February 7th.

Marylebone.—February 26th. Stores and materials for a year, for the B.C. Electricity Department. See "Official Notices" February 7th.

Shoreditch.—February 24th. Two economisers (Green type), for the B.C. electricity department. See "Official Notices" to-day.

Stepney.—March 17th. Boilers and boiler house accessories, turbo-alternators, condensers, accessories and switchgear, for the B.C. See "Official Notices" to-day.

Manchester.—February 18th. General stores for a year, for the Corporation tramways department. See "Official Notices" January 31st.

February 18th.—Motor-'buses complete, for the Tramways Committee. Mr. J. M. McElroy, manager.

February 19th.—Providing and fixing electric light fittings at George Leigh Street Municipal School, Ancoats. Returnable deposit £1 1s. Mr. C. H. Wyatt, Director of Education, Education Offices, Deansgate.

Neath.—March 3rd. One 400-kw. high-speed engine, direct-coupled to a two-phase alternator, and accessories, for the R.D.C. See "Official Notices" to-day.

Newport (Mon.).—March 4th. Electric light fittings for the B. of G. Mr. A. H. Rees, Clerk, Queen's Hill.

February 22nd.—Stores for a year, for the Corporation Electricity and Tramways Committee. See "Official Notices" to-day.

Oldham.—February 21st. Two 500-kw. motor-alternators, for the Corporation. See "Official Notices" February 7th.

Rochdale.—Engine room extension, new boiler house, &c., turbo-alternator, condensing plant, motor-alternator, water-tube boilers and boiler house equipment for the Corporation. See "Official Notices" February 7th.

South Africa.—A new electric main hoist is required for the Village Deep gold mine. The Cape Town Municipality will be purchasing for suburban extensions during the next six months, 33 miles of aerial braided wire, 15 miles of vulcanised rubber wire, one mile of concentric high-tension cable, and 1,100 yd. of three-core high-tension cable.—*British and South African Export Gazette.*

South Shields.—February 17th. Uniforms, for the Corporation tramways department. See "Official Notices" January 31st.

Stockton-on-Tees.—February 19th. Stores for a year, for the Corporation Electricity Department. Electrical Engineer.

Swansea.—Electric light installation at new Y.M.C.A. premises. G. Moxham, architect, 18, Castle Street, Swansea.

Swindon.—March 8th. General stores and materials for a year, for the Corporation electricity and tramways departments. See "Official Notices" to-day.

March 10th.—One 500-kw. mixed-pressure turbine and condensing plant, boiler feed pump and pipework, and one switchboard panel and cables, for the Corporation. See "Official Notices" to-day.

Uruguay.—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

Walthamstow.—February 28th. Four double-deck tramcars complete with magnetic-brake equipments, for the U.D.C. See "Official Notices" February 7th.

Warlingham.—February 24th. Electric light sundries for the Mental Hospital, for Croydon T.C., for a year. Mr. F. C. Lloyd, Town Clerk, Town Hall, Croydon.

Warrington.—March 5th. Motors and transformers for a year, for the Corporation. See "Official Notices" to-day.

Wigan.—February 24th. High-tension, three-core feeder cable, transformer and switchgear, for the Corporation. See "Official Notices" to-day.

Wimbledon.—March 5th. Stores and materials, for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

Wrexham.—March 1st. Stores for a year, for the Borough Electrical Engineer's department. See "Official Notices" to-day.

CLOSED.

Australia.—According to *Tenders* (*Mining and Engineering Review*), the following contracts have been placed:—

P.M.G.'s Department, Queensland.—Five tons hard-drawn copper wire, £97 1fs. per ton.—British Insulated & Helsby Cables, Ltd.

N.S.W. Public Works Department.—Electric passenger lift at Mr. Robinson's shops, George Street, North Sydney, £500.—Standard-Waygood, Ltd.

Belfast.—The Harbour Board has accepted the tender of Messrs. George Russell & Co., Ltd., amounting to £8,725, for the construction at Alexandra Wharf, of an electric derrick crane capable of lifting 120 tons.

Bradford.—The Corporation Electricity Committee has accepted the offer of Messrs. Electromotors, Ltd., to supply two 10-H.P. direct-current slow-speed motors required for the stoker drive at Valley Road electricity works.

Burnley.—The Tramways Committee has accepted the tender of the United Electric Car Co., at £153 per car, for the conversion of 14 wind-shield cars to top-cover cars.

Canterbury.—The T.C. has accepted the tender of Mr. S. Terry, Canterbury, for electrical engineering work for the ensuing half-year.

Colchester.—The T.C. has accepted the tender of Messrs. H. G. Merry & Co. for 300 tons of Shirebrook nutty slack for the electricity works, at 15s. 0½d. per ton.

Dewsbury.—The Electricity and Tramways Committee has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for new boilers.

France.—After comparative trials of a number of types of motors, the Compagnie des Tramways de l'Est Parisien has placed an order with the Société Anonyme Westinghouse for 100 50-H.P. No. 307 type motors; also for the new type of Westinghouse non-automatic multiple control equipments.

Hemsworth.—The R.D.C. has accepted the tender of Messrs. R. Farr & Sons, of Doncaster, for the installation of telephones at the Isolation Hospital, at £47.

Horsham.—The U.D.C. has accepted the tender of Messrs. Heenan & Froude for mechanical hoppers for the refuse destructor, at £122.

Italy.—The Ganz Electricitäts Gesellschaft, of Budapest, has secured a contract for the construction of an electric railway about 20 miles long, between Angera, on Lake Maggiore, and Varese.

Liverpool.—The Corporation has just placed an order with Halley's Industrial Motors, Ltd., for a petrol motor-tower wagon chassis for use in connection with the maintenance of tramway conductors.

London.—The following tenders have been accepted by the Metropolitan Water Board for the undermentioned supplies:—

British Insulated and Helsby Cables, Ltd.—Aluminium cable, £51.
Henley's Telegraph Works Co.—Paper-insulated lead-covered cable and joint boxes, £88.
Edison & Swan United Electric Light Co., Ltd.—700 drawn-wire metal-filament lamps, at 1s. 7d. each.

L.C.C.—The Highways Committee has accepted tenders of the British Insulated and Helsby Cables, Ltd., and Messrs. Brecknell, Munro, & Rogers, Ltd., at £123 and £113 respectively, for overhead fittings.

The following tenders were received for number plates for indicating the routes of cars on the Council's tramways:—

Venner's Signs, Ltd.	(accepted)	£3,805
Brush Electrical Engineering Co., Ltd.		6,070
Hurst, Nelson & Co., Ltd.		7,486

A contract has been entered into with Messrs. Quilliam Bros. for five Collins electric point turners, for £425, "subject to no payment being made until the saving in expenses effected by their use is equivalent to the cost of the machines." This is in place of a contract placed last October with Messrs. S. Stone & Co., who are agents only.

During the Christmas recess the Education Committee received tenders as below :—

CAMBERWELL, N.—L.C.C. Camberwell School of Arts and Crafts.—Extension—Electric lighting—

A.E.G. Electric Co., Ltd.	(withdrawn)	£903
Tredegar & Co.	(accepted)	912
G. Weston & Sons, Ltd.		938
E. Lawrence & Sons, Ltd.		1,061
C. H. Cathcart & Co.		1,245

KENNINGTON.—Vauxhall Street School—Electric lighting—

Tredegar & Co.	(accepted)	£434
G. Weston & Sons, Ltd.		454
A.E.G. Electric Co., Ltd.		484
W. C. Tackley & Co., Ltd.		499
E. Lawrence & Sons, Ltd.		530
C. H. Cathcart & Co.		570
British Economical Lamp Co., Ltd.		770

Manchester.—Various committees of the Corporation have accepted the following tenders :—

Manchester Steam Users' Association.—Periodical inspection and insurance of four water-tube boilers, superheaters and economisers at Stuart Street station.

Tudor Accumulator Co., Ltd.—Testing battery at the cable stores, Ardwick.

British Electric Transformer Co., Ltd.—Requirements of A.C. balancers during the period ending December 31st, 1913.

British Insulated and Helsby Cables, Ltd.—Requirements of additional sizes of fuse boxes during the period ending June 30th, 1914.

Siemens Bros. & Co., Ltd.—Paper-insulated cable.

Newcastle-on-Tyne.—A contract for tramcar meters for Newcastle-on-Tyne tramways, has been received by Messrs. Ferranti, Ltd.

Newcastle-under-Lyme.—The T.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for cables for extensions.

North-Eastern Railway.—Messrs. Siemens Bros. have secured the contract for the electrical equipment (motors, gears, control equipments, &c.,) for the ten electric freight locomotives to be used in connection with the electrification of North-Eastern Railway Co.'s mineral line between Shildon and Newport (Middlesbrough).

Nuneaton.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for a water-tube boiler for the electricity works, at £800.

Rotherham.—The T.C. has placed an order with the R.E.T. Construction Co. for the supply of two trolley vehicles, at £765 each. The tender of Anderton & Beatson has been accepted, at £298, for installing electric light at Kimberworth Schools, plus 12s. 6d. each for any extra points required.

Salford.—The Corporation Electricity Committee has authorised the purchase of two overload circuit breakers for the new battery, from Mr. Bertram Thomas, at £90.

Sheffield.—The T.C. has accepted the tender of Messrs. John Brown & Co., Ltd., for 600 steel tramcar tires, at 26s. per tire. The tenders of the Staveley Coal and Iron Co., Ltd., for 10,000 3-in. cast-iron cable pipes, at £6 10s. a ton, and of Messrs. W. Marlow & Sons, at £1,780, for foundations for three new boilers, chimney base, &c., at the Neepsend power house, have also been accepted. The contract with Messrs. Marsh Bros. for the maintenance of the internal telephone system at the Council's hospitals is to be extended for a further period of 12 months.

Stone (Staffs.).—The U.D.C. has accepted the tender of Messrs. Blackburn, Starling & Co. for the electric light installation at the sewage works, at £108.

Stretford.—The tender of Messrs. Veritys, Ltd., has been accepted by the U.D.C. for a 15-H.P. totally-enclosed interpole motor.

Sunderland.—The T.C. on Wednesday accepted the following tenders :—

British Insulated and Helsby Cables, Ltd.—550 yd. of L.T. cable and 5,000 yd. of L.T. cable.

Ferranti, Ltd.—50 meters.

Tonbridge.—The U.D.C. has accepted the tender of Messrs. Switchgear & Cowans, Ltd., for alterations and additions to the switchboard at the electricity works, at £147.

Walsall.—The T.C. has placed an order with Messrs. Babcock & Wilcox, Ltd. (£290), for a mechanical stoker at the generating station.

West Ham.—An offer of the Glasgow Railway Engineering Co., Ltd., has been accepted by the T.C. for the supply of 200 cast-steel tram wheels and tires, at £4 1s. 6d. each. The Council's contracts with the Fuller Electrical Co. for semi-enclosed A.C. motors, and Messrs. Baxter & Caunter for Credenda conduit, are to be extended for a further period of 12 months, as is also the contract with the Armorduct Manufacturing Co. for wires and cables, at the present price up to 7/14 size, and above at from 5 to 15 per cent. advance, according to size.

Wolverhampton.—Owing to a breakdown, No. 1 motor-generator is to be repaired by the Electric Construction Co., Ltd., for £400, and No. 2, by the same company, for £57. A new canal boat is to be purchased at an estimated cost of £75.

FORTHCOMING EVENTS.

Physical Society.—Friday, February 14th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Annual general meeting.

Junior Institution of Engineers.—Friday evening, February 14th.—At 39 Victoria Street, S.W. Paper on "Electrical Installations in Metal Conduit with Special Reference to Earthing," by Mr. F. H. Taylor.

Saturday, February 15th.—At 6.30 p.m. At the Hotel Cecil. Annual dinner.

Institution of Mechanical Engineers.—Friday, February 14th. At 8 p.m. Annual general meeting. Paper on "Modern Condensing Systems," by Mr. A. E. L. Scanes.

Association of Mining Electrical Engineers (West of Scotland Branch).—Saturday, February 15th. At 4.30 p.m. Meeting at the Royal Technical College, Glasgow.

(**Newcastle Branch**).—Wednesday, February 19th. At 7 p.m. At the Armstrong College, Newcastle. Lecture on "The Development of Mechanical Power in the Mines of the North-Eastern Coalfield—a Comparison and a Contrast," by Mr. R. Nelson (H.M. Electrical Inspector of Mines).

Institution of Electrical Engineers (Scottish Section).—Saturday, February 15th.—At 7.30 p.m. At the Grosvenor, Glasgow. Annual smoking concert.

(**Western Section**).—Monday, February, 17th. At 4 p.m. At the Merchant Venturers' Technical College, Bristol. Address on "Some Uses of the Stroboscope," by Prof. D. Robertson. At 6.30 p.m. At St. Stephen's Restaurant, Bristol. Dinner.

(**Manchester Students' Section**).—Tuesday, February 18th. At 7.30 p.m. At the Municipal School of Technology, Manchester. Paper on "Time Limits," by Mr. H. R. Constantine.

(**Students' Section**).—Wednesday, February 19th. At 7.45 p.m. At the Institution, Embankment, W.C. Paper on "Some Problems of Electricity Supply," by Mr. G. W. P. Page.

Birmingham and District Electric Club.—Saturday, February 15th. At 6.30 p.m. At the Swan Hotel, Birmingham. Annual dinner.

Illuminating Engineering Society.—Tuesday, February 18th. At 8 p.m. At the Royal Society of Arts. Paper on "The Use of Shades and Reflectors," by Messrs. J. G. Clark and V. H. Mackinney.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, February 21st. At 7.30 p.m. At the Lit. and Phil., Newcastle. Lecture on "Surface Combustion," by Prof. W. A. Bone.

Royal Institution.—Saturday, February 22nd.—At 3 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir. J. J. Thomson. (Lecture III.)

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, February 17th.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Tuesday, February 18th.—"B" Company. Company training, 7 to 10 p.m.

Thursday, February 20th.—"C" Company. Company training, 7 to 10 p.m.

Friday, February 21st.—"D" Company. Company training, 7 to 10 p.m.

Saturday, February 22nd.—"A" and "B" Companies (Right Half Battalion). Week-end training at Dover. Dress:—Service dress, putties and greatcoats. No arms will be taken. Parade at Victoria Station, L.C. and S.E. line, at 1 p.m.

"C" Company.—Week-end lorry run. Parade at Headquarters at 2 p.m. Dress:—Service dress, putties and greatcoats.

Headquarters will be open from 10 a.m. till 12 noon for regimental business.

(Signed) J. H. S. PHILLIPS, Major,
For Officer commanding L.E.E.

NOTES.

Parliamentary.—SHEFFIELD CORPORATION BILL.—As stated in the ELECTRICAL REVIEW of last week, the House of Lords passed a new sub-clause in the Sheffield Corporation Bill dealing with electrical fittings. Lord Southwark, who moved the new clause, stated that it was by way of a compromise.

On Monday the Bill again came before the House of Commons, when Mr. Maclean proposed that the House should agree with the Lords in the amendment.

Mr. Pointer said that since the matter was last before the House there had been the usual negotiations, and, ultimately, driven by force of time, the Corporation agreed to the clause as it had been read. He did not know whether what it meant was fully appreciated. It meant that while it appeared on the surface that the Corporation had agreed to the compromise, in reality they had given everything away. Let any member of the House judge what he would do in the circumstances. If he were going to have electric light installed in his house, and had the idea of employing the Corporation to do the work, the Corporation could only carry the wires so far as the ceilings and walls, and then he would have to call in a private trader to finish the task. Every one of them would be inclined to give the order to the man who could complete the transaction right through. Therefore, while, on the face of it, it looked like a compromise, in fact, the Corporation had undoubtedly given all the work to private traders. He viewed that with

regret, but they were driven right to the tail end of the session, and if they disagreed with the Lords' amendment, and the Bill went back again to the Lords, it would be lost, and the Corporation would sacrifice improvements to the value of over £100,000. Because of the exigencies of time, therefore, he proposed to offer no opposition to the amendment. The question was then put and agreed to.

Parliament and War Office Contracts.—In Saturday's Parliamentary Papers Mr. Touche asked the Secretary of State for War if he would say whether the German cable used at Tidworth and Bulford camps was being insulated with re-manufactured rubber or partly so. Col. Seely replied that it was understood that a certain amount of re-manufactured rubber was used in the outside vulcanised covering of the cable, which was mainly for mechanical protection for the pure rubber inner covering. The rubber used was subjected to mechanical tests and found quite satisfactory. Replying to Mr. Touche on Tuesday, Mr. Baker said that there had been no other War Office contracts given out in respect of other works, besides those at Tidworth and Bulford, in which German cable had been used.

Mr. Touche then asked the Secretary of State for War to say whether the inspectors representing the War Office were present throughout the manufacture at Eschweiler, Germany, of the cable for the Army camps at Tidworth and Bulford, or did they merely inspect and test the completed cable: and was the former practice followed in respect of cable manufactured for War Office use in this country?—Mr. Baker said the inspectors tested the cable during the course of manufacture, and again on completion. The same practice was adopted in respect of cable manufactured in this country.

Mr. Touche further asked whether there was any clause in the specifications for the work at Tidworth and Bulford Camps in which the German cable was employed, requiring the use of pure Para rubber only and excluding the use of re-manufactured rubber?—Mr. Baker replied that there was no such clause, but it was specified that the layer next to the conductor was to be of pure rubber, and the other two of vulcanised rubber. The quality of the whole was covered by a mechanical test.

Manchester Electro-Harmonic Society.—The next concert of this society is to be held on Friday next, February 21st, at the Albion Hotel, Manchester, with Mr. S. L. Pearce in the chair. We have received an advanced copy of the programme, from which we gather that those present will be regaled with a splendid selection of items—violin, 'cello, vocal solos and humorous selections, the artistes being as follows:—Solo violin, Mr. J. Sedgwick Bridge; solo 'cello, Mr. J. H. Foulds; soloist (bass), Mr. Hamilton Harris; entertainer, Mr. Wilfrid Ludlow; pianist and accompanist, Mr. E. Bennett North. It is expected that there will be present quite a large attendance of local gentlemen who are intimately connected with the electrical trade, and we would urge our readers in and around the Manchester district to make arrangements to support the society on this occasion. Seeing that during the evening there will be five intervals of ten minutes or more each, between 7.30 and 11 o'clock, in which one can fraternise and converse to his heart's content, there will no doubt be a large company present, and the event should be a very popular one.

Annual Socials and Dinners.—Norwich.—On Friday last the employés of Messrs. Laurence, Scott & Co. were entertained at dinner, the chair being taken by Mr. Cecil Wilson, who apologised for the absence of his co-directors, Mr. R. Laurence and Mr. W. H. Scott. The vice-chair was occupied by Mr. W. Alcraft, who proposed "Success to Laurence, Scott & Co., Ltd.," and took the opportunity of welcoming Mr. Gilbert Scott. Mr. Alcraft congratulated the directors upon the large amount of business in hand, and said that 1912 had been the hardest year so far experienced at the works. A kindly feeling existed between the directors and the employés, and half wages had been paid to those who had been unable to work during the Norwich August flood. The chairman, in responding, said recent coal and transport strikes had caused great concern to the directors, who had, however, at considerable difficulty and expense, managed to obtain a sufficient supply of coal and materials to keep the works going. Business had scarcely recovered from the effects of the strikes, when the works were disorganised by the August flood. Fortunately, the actual damage done was relatively small, but there was much loss of time and consequent delay in the completion of orders. The firm had now an extraordinary amount of work in hand, including orders for the British Admiralty and the Navies of Spain, Chile, Brazil, Turkey and Japan. Other toasts followed.

London.—The fourth annual dinner of the Admiralty Superintending Electrical Engineers' staff took place on Saturday last at the Café Monico, Piccadilly, W. The toast of "The Chairman" was entrusted to Mr. W. McClelland, who referred to his sterling qualities and his long and pleasant association with him. The toast was received with acclamation, and drunk with musical honours. The chairman, Mr. C. H. Wordingham, M.I.C.E., replied in a humorous speech. During a pleasant evening the vocal abilities of some of the staff were "unearthed." The arrangements were carried out by a Committee, consisting of Messrs. Green, Shaw, Mortimer, Graham, Broomfield and Skinner (hon. secretary).

Kirkcaldy.—About 300 employés and friends of the Kirkcaldy tramway and electric lighting departments were present at the tenth annual social and dance on 5th inst.

London.—The second annual dinner of the Central Electric Athletic Club was held at the Eyre Arms Hotel, Wellington Road, N.W., last Saturday evening. In the absence of Mr. F. J. Walker, owing to slight indisposition, the chair was taken by Mr. S. T. Dobson, supported by Messrs. D. T. Powell, W. E. Rowland, F. Napier, W. J. D. Partridge, T. Brice, W. Burgess, W. Pummell, S. Green and H. Stephens. The hall was well filled by members of the staff and their friends, numbering about 70. The chairman alluded to the regrettable absence of Mr. H. P. Gaze, who was recuperating in Switzerland, and gave the toast of "The King," which was suitably honoured. The prizes were then distributed, H. P. Gaze being again the winner of the "Leaf Challenge Cup," and A. W. Law, the runner-up. The Donegal Badge was won by J. K. Wells, S. G. Rhodes and H. Cope being second and third respectively. The concert which followed was arranged by Mr. H. Morton, and was much enjoyed, the artistes being Miss Winifred Mansfield, Mr. Dick Dudley, the Concellano Trio, Messrs. H. Morton and J. Clayton, D. T. Powell, W. Cornell, H. Pummell, D. Edwards and F. Lawson, the accompanist being Mr. James Swift.

London.—On Saturday last Messrs. Rawlings Bros. entertained about 400 of their employés and their wives and friends at their annual social gathering. We have it on very good authority that everyone present realised that the true democratic spirit reigned supreme and, as Mr. W. R. Rawlings, who presided, stated, the success of the firm in all its various departments was attributable to the loyalty of the employés. During the evening refreshments were served and a high-class entertainment was provided, Mr. Arthur Hill with his "marionette" and "wally" shows, and also his son of less than seven years of age, gave a very fine entertainment. Fine renderings on the piano and violin were given by Mr. W. Hazel and Mr. Conrad Benjamin respectively. Mr. Bert Finch and Mr. Bert Russell amused the audience with humorous songs, and Mr. Frank Heritage again appeared with his 'cello. Miss Margaret Ward Smith, contralto, and Mrs. Rowden, wife of one of the directors, gave a fine rendering of sentimental songs, while Miss Gladys Ely held the audience spell-bound with clever character sketches. Miss Evelyn Key acted as accompanist.

Cheshire.—At the Brooklands Hotel, Cheshire, on Saturday, 8th inst., the employés of the Record Electrical Co., Ltd., held their first annual dinner. The muster was exceedingly good, including as guests the London office staff and the directors of the company. The chairman of the company, Mr. C. W. von Roemer, toasted "The King," being followed by Mr. A. James, who proposed "The Company." For the latter, Mr. Record, in replying, expressed his great pleasure at the good feeling shown by the invitation given to the directors to be present at the works dinner. The chief of the testing department, Mr. J. H. Care, toasted "The Directors," and advised all to work for collective benefit rather than for individual gain. Mr. von Roemer, in replying, referred to the advance and success which had attended the company's efforts since its incorporation. The "Star" turn of the evening was introduced when the works superintendent, Mr. W. G. Dyment, toasted "The Office Boy." The concert which followed afforded much amusement, members of the staff and works showing their talent in various directions; the entertainment finished with a quintette rendered by "Sum Sparkes." A few words from Mr. T. J. Boorne, the commercial manager and director, brought the proceedings to a close.

Leicester.—The works and office staff of Messrs. Gent & Co., Ltd., Faraday Works, Leicester, held their third annual social and dance on Tuesday last week at the Queen's Hall. An excellent concert programme, provided by the works "artistes," was followed by dancing, and over 200 of the employés and their friends spent a most enjoyable evening. The "Shop Social," originally held to celebrate the firm's commencement upon the construction of the largest electric clock in the world, now shares with the "Shop Holiday" the distinction of being an annual fixture.

Foreign Trade in January.—Compared with the figures for January, 1912, the trade returns for last month show a continued advance, both in imports and exports. The former increased in value by 4¼ millions sterling, or 6·3 per cent., the exports by over 5 millions sterling, or 12·4 per cent., and the re-exports by about 1½ millions sterling, or 11·5 per cent. The figures relating to electrical trade in comparison with those for the corresponding month of 1911, are as under:—

Imports.

Electrical goods and apparatus (other than machinery and uninsulated wire)	£136,192, a decrease of £3,804
Machinery	£673,727, an increase of £158,780

Exports.

Electrical goods and apparatus (as above)	£368,618, an increase of £93,527
Machinery	£3,112,474, an increase of £445,832

Fatalities.—St. Just.—An inquest was held on 6th inst. into the death of a boy named Wallis, aged 15, of Botallack, who was killed on the previous evening by catching hold of a live wire on the Botallack mine property. He was employed in the carpenter's shop at Levant mine. From the evidence given it appeared that near the Nineveh section of Botallack, the overhead wires crossed the road near a stile, and one of the wires had sagged to within 2 ft. of the ground. Wallis was seen to catch hold of it and move it out of his way, and he dropped to the ground immediately. Another boy (Maddern) went to his assistance, and he likewise fell. The path was a public one, and there was no fence under the wires to prevent their falling to the ground. The supply was at 440 volts, received from the Hayle power station

Mr. A. Climas said that when he arrived on the scene the boys were unconscious, and artificial respiration was applied, with success in the case of Maddern, but it was applied for an hour in the case of Wallis without effect. The coroner said that he could not understand why the Urban District Council did not have the public path protected from the wires, and Mr. Climas, in reply, said that he understood that such a protection had not to be placed over an ordinary path. The mine wire was down, because some telephone wires passing beneath it had became entangled with it for some unaccountable reason. That caused a short, and burnt the wire through. A verdict of "Accidental Death" was returned.

DUBLIN.—On the 6th inst. an inquest was held in Dublin on the remains of Edward Blance, 43, who was killed by contact with an electric wire in the works of Messrs. Dennehy, motor engineers. It appeared that Blance was assisting in putting a motor into the garage when it came into contact with an electric wire which was hanging down from the supply leads to a lamp. The wire, which was insulated to within ½ in. of the end, touched the brass of the wind screen. Blance fell down unconscious. It seemed that on other occasions the end of the wire had been lapped up and insulated. The jury found that Blance died from shock caused by the wire, and added that the wire was not properly protected.

Electricity on the Rand.—Mr. J. W. Kirkland, President-Elect of the South African Institute of Electrical Engineers, in proposing a toast at the annual dinner of the Institute last month, said: It must be admitted to be a fact that electricity has at last come into its own on these gold fields. As evidence of this, we have at present serving the greatest gold mines in the world with electric power what is destined to be, in the near future, the largest electric power supply company in the world. Within a very short time the output of the Victoria Falls and Transvaal Power Co. will be greater than that of any other single power company, the second being the Commonwealth Edison Co., which, in Chicago, serves a population of almost 3 million people. The men connected with the Victoria Falls and Transvaal Power Co. have been, and are now, the backbone of our local Institute. Later, according to a report in the *South African Mining Journal*, Mr. Kirkland said: "Electricity is being called upon here to work larger hoists and larger air compressors, and to be led more extensively underground than anywhere else, and the difficulties attendant upon these new problems will be met here locally, and, to a very considerable extent, by the men who are, or at least who ought to be, members of our Institute."

A Large Electromagnet.—It is proposed to provide the Sorbonne with the largest electromagnet in the world. It is claimed that an electromagnet of the kind described will permit of discoveries of the highest importance for the future of humanity.

Electrical Trades Union.—On Tuesday, February 18th, at 9 p.m., a lecture will be delivered by Mr. John Potter (London District Secretary of the E.T.U.), at the Princess of Wales, corner of Belsize Road and Abbey Road, N.W., under the auspices of the North-Western Branch of the Electrical Trades Union. Subject, "Foreign Policy from a Worker's Point of View." Questions and discussion will follow. All electrical workers are invited.

Electrolytic Copper in Rhodesia.—According to the *South African Mining Journal*, a copper smelting plant on the Siemens & Halske electrolytic process is to be installed in Northern Rhodesia, which will ultimately be capable of dealing with 200 tons of ore per day. Enormous quantities of high-grade ore have been located in the mines concerned, and the process has been experimentally proved suitable for dealing with it.

A Loughborough Celebration.—A Loughborough correspondent informs us that a number of the office staff of the Brush Co., who have recently been suddenly dismissed, held a dinner and smoking concert on 6th inst., to celebrate the event, at the Central Hotel. We have received a copy of the unique menu card prepared for the occasion.

Football.—The undefeated football team of the Witton Works of the General Electric Co., Ltd., successfully upheld its reputation against the G.E.C. London Head Office team, in a match played last Saturday, February 8th, at Nestanglo Sports Club Grounds, Elmer's End. The weather conditions left nothing to be desired, and the large number of enthusiastic supporters of both teams who turned out were treated to a quick, snappy game, which called forth cheers and applause for many of the players. The resulting score was:—Witton, 5 goals; G.E.C. Head Office, 3 goals. In the evening, an enjoyable dinner and entertainment were provided, at which the "boys from Witton" were guests. The festivities took place at "The Mitre" Restaurant, in Chancery Lane, under the chairmanship of Mr. Balchin. About 70 gentlemen were present. Members of both teams, as well as other members of the G.E.C. staff, furnished the vocal and instrumental music; amongst these were Messrs. Jones, Hall, Balchin, Knight, Plumley, Haughton, Mace, Copley, Bryam, Hudson, Orton and others. Mr. Muir, the honorary secretary of the G.E.C. Football Club, laboured diligently to make the occasion a success.

Manchester Engineers' Club.—A general meeting of the members of the Manchester Engineers' Club was held on Wednesday, the 5th inst. The chairman (Mr. Daniel Adamson) presided, and there were about 100 members present.

The Committee presented a report comprising a statement of the business done, with proposals for the future. The chairman stated that at the present time 570 members had been enrolled, and that applications had been received from about another 100 persons. The funds in the bank standing to the credit of the club were £2,600. The number of members who had guaranteed payment of their subscriptions for a further term of four years ensured an income sufficient to pay the rent of the club premises for the same period. The response from life members had been very encouraging.

To get over any difficulty in connection with the licensing laws, it was resolved that a limited company be formed with a capital of £3,000 in £1 shares, which should have power to borrow money upon debentures. The company will sub-let the furnished premises to the club through trustees for the club appointed by the Committee, the rent charged by the company to be sufficient to pay the rent as stated in the lease, interest on debentures and on share capital, and the small expenses of the company. In order to utilise the available funds of the club, it is proposed that the club shall, through their trustees, take up shares or debentures in the company to the extent of about £1,500. This will leave about £1,500 to be provided by means of subscriptions for shares and debentures, and members will have an opportunity of subscribing for these.

The premises which the Committee has agreed to take are situated in Bridgewater Buildings, in Albert Square. The premises have been used in the past as a club, but they are to be entirely refurnished and suitably decorated.

It was resolved, on the recommendation of the Committee, "that the time limit for admission of original members without entrance fees be extended at the discretion of the Committee, so long as not more than 600 members (exclusive of losses by resignation or otherwise) are so admitted, nor the time for such admission made later than the formal opening of the club premises." It was intimated that if the share capital of the proposed new company was forthcoming at an early date, the club would be opened in May next.

Inquiries.—A correspondent asks for the names of makers of the Hailwood No. 1 miner's electric lamp, and the Oldham emergency electric lamp. Makers of the "Sterling" organ-blowing fan and of the "Century" A.C. motor are asked for.

Institution and Lecture Notes.—ASSOCIATION OF ELECTRICAL STATION ENGINEERS.—The second general meeting was held at 69, Fleet Street, London, E.C., on Thursday, February 6th, and the attendance exceeded 50. The secretary reported that excellent progress had been made since the previous meeting, and that arrangements were being made for similar meetings in other important centres in the United Kingdom (which would be duly advertised). Application forms had been circulated to all inquirers, and were being steadily returned, filled in and with application fee. The latter, the secretary stated, was of great importance, as the "Association" was very short of funds, and the quick return of all application forms with fee would be much appreciated. The interest aroused by the forming of the A.E.S.E., he said, was now world-wide, and inquiries from British electrical engineers abroad wishing to become members were being received, even from as far off as Brazil. After receiving the report of the secretary, the meeting proceeded to appoint a committee of 20, and it was agreed that it should be only provisional, and should meet as soon as possible to examine application forms and to institute propaganda work. It was agreed that the annual subscription should be 10s. 6d., payable half-yearly, with an entrance fee of 2s. 6d. The question of qualification of members led to a very long discussion, and as it was found difficult to define exactly what constituted the training and experience of a qualified man for the various positions covered by the A.E.S.E., it was decided to let the Committee judge each application on its merits. With regard to provincial branches, the secretary stated that already a few gentlemen had undertaken the duties of district secretaries (*pro. tem.*) in some important centres. It was agreed that funds should be supplied to branches for propaganda purposes, &c. The Committee is to make arrangements at once with a chartered accountant with regard to the finances of the A.E.S.E. A meeting of the Committee was to take place on Tuesday, February 11th.

A meeting was held on Friday, February 7th, at the Grosvenor Hotel, Dublin (at which 20 gentlemen were present) to consider the advisability of forming a branch of the above "Association" in Dublin. A number of suggestions were made, and were forwarded to the central organisation in London, and a meeting is to be held to-day, February 14th, to consider the replies from London; subject to these being satisfactory, it was decided to form a branch at once.

SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS.—Last month Mr. J. W. Kirkland was appointed president of this Institute. Mr. J. H. Rider, in his valedictory address (as reported in the *South African Mining Journal*) urged members to come forward and read papers and take part in discussions. Unless they were prepared to do so, the value of such institutions was greatly reduced. Every engineer should disseminate his knowledge and experience, and he (Mr. Rider) was convinced that an engineer gained much more than he apparently lost by a free exchange of ideas with his fellows. Further, experience had taught him that he who kept his ideas strictly to himself seldom rose in his profession. If all members of scientific societies freely exchanged experiences, and were neither afraid nor ashamed to get up in a discussion and speak of their difficulties and troubles, the result would be that each individual member would only "give away" his own little bit, and he would receive in exchange the "little bits" of all the other members, and surely the whole was greater than its part. In conclusion, Mr. Rider gave the following advice to electrical engineers:—"Take every opportunity to improve your knowledge and experience, accommodate yourself to the circumstances in

which you find yourself placed, and, above all, be absolutely loyal to your employers and those who may be your official superiors. Do not try to get on too quickly, and, when the opportunity comes, do not be slow to seize it. Don't slacken off your energies because your reward seems to be a long time coming, and, if it should never come in the manner in which you desire, you will have the best of all rewards—the satisfaction of having done your duty."

The Institution of Engineers and Shipbuilders in Scotland and the Institution of Naval Architects have arranged a joint summer meeting, to be held in Glasgow on June 24th, 25th, 26th and 27th. The details of the programme have not yet been arranged, but the majority of the meetings will be held in the rooms of the Scottish Institution.

Institution of Electrical Engineers (Manchester Section).—A meeting of the Section was held on Tuesday evening last, when a paper was read by Mr. H. Clifford Palmer on "Advertising Electricity." A discussion followed, to which Mr. Palmer replied.

On Wednesday, at Leeds, a paper was read by Mr. T. Harding Churton on "Some American Electric Plants." A discussion followed.

At the Institution dinner, on February 6th, M. Grosselin, President of the Société Internationale des Electriciens, conveyed to the members an invitation from his Society to visit Paris next May. The invitation has been accepted by the Council of the Institution, and, as soon as sufficient details are available, a circular on the subject will be sent to the members. At present it is proposed that the visit should take place during the last week in May, and that it should last three days, the time being given partly to the reading and discussion of papers and partly to visits to works and places of interest, and a banquet.

Institute of Metals.—The annual general meeting will be held at the Institution of Mechanical Engineers, Storey's Gate, S.W., on Tuesday and Wednesday, March 11th and 12th. Among the papers to be read on the latter date are the following:—Dr. G. H. Bailey on "Corrosion of Aluminium"; Mr. Alexander Siemens on "Metal Filament Lamps."

In the course of a paper on "Electricity in Relation to the Architect's Practice," read by Mr. R. N. Tweedy before the Architectural Association of Ireland last week, Mr. Tweedy said that in the Dublin shops the lighting arrangement was so atrocious that they only saw the light and not the object.

Protection from X-Rays.—It has long been known that silk can be loaded with various metallic salts, and advantage is taken of the fact in commerce to sell silk which is sometimes weighted with as much as 150 per cent. of tin salt. A more legitimate use of this absorptive power of silk is described by Mr. C. Ainsworth Mitchell, in *Knowledge* for February, who says that M. L. Droit has found that by using certain lead salts for the weighting, a silk fabric may be rendered opaque to the passage of X-rays. For example, a material thus prepared by treatment of the silk with lead phosphotannate and other salts contained 68 per cent. of mineral matter, including 34 per cent. of lead oxide, 24 per cent. of tin oxide, 8 per cent. of phosphoric anhydride, and 2 per cent. of lime and alkalis. Slight discharges of X-rays were practically arrested by two layers of this fabric, while six layers were found a sufficient protection to the skin against the action of an ordinary discharge of medium strength. This fabric had the same protective effect as a sheet of copper 0·044 mm. in thickness, and had the great advantage of flexibility, even when used in a thickness of several layers.

An Oil Turbine.—A description was recently published in *The Syren* of a turbine invented by Messrs. Gavan and Leon Inrig, which is of the internal-combustion type, and is fed with oil. The turbine is of the double-flow pattern, with an admission port at the centre, the drums and casing taking the form of two truncated cones united at their narrow ends by a short cylindrical portion. Compressed air at high temperature and 960 lb. per sq. in. is forced in through the port, followed by a charge of oil, which ignites as in the Diesel engine; water is then sprayed into the combustion-chamber, and is immediately vaporised, the hot gases and steam expanding through the blading. It is stated that owing to the use of steam the blading is not exposed to an excessively high temperature; in fact, the casing is lagged to retain the heat. A turbine of 65 H.P. is under construction.

Educational Notes.—Gifts amounting to £150,000 have been presented to the Bristol University for extensions by Messrs. G. A. and H. H. Wills and £20,000 by Mr. W. M. Wills. Their father, Mr. H. O. Wills, gave £100,000 to the University in 1908.

Business Announcements.—Messrs. Berry, Skinner and Co., of Oozells Street, Birmingham, will represent Messrs. Nalder Bros. & Thompson, Ltd., in the Midland district in future, and, for the convenience of local customers, they will shortly hold a stock of instruments in current demand.

Transmutation of Matter.—Recent researches conducted by Sir W. Ramsay, and by Prof. N. J. Collie and Mr. H. Patterson, indicate that, under certain conditions, helium and neon are produced by the electric discharge in an X-ray bulb containing hydrogen at low pressure. The experiments have been carried out independently with extreme care, and the investigators express confidence in the results. On the other hand, Prof. Sir J. J. Thomson, who has been engaged in similar work, considers that the neon and helium are derived from the glass or the electrodes employed, as the production ceases after a few days, but recommences if the electrodes are changed.

Appointments Vacant.—Junior assistant engineers, for the Newcastle-upon-Tyne Electric Supply Co., Ltd. (10s.). See our advertisement pages in this issue.

Remote Control of Street Lamps.—In a communication to the Institution of Electrical Engineers, by Mr. W. Duddell and Messrs. Handcock & Dykes, a new system for the control of public and private lamps, meters, transformers in sub-stations, &c., by means of tuned selective relays actuated by resonance with a "ripple" of alternating current injected into the distributing mains, is described. To-day the system is to be demonstrated in operation on the mains of the Egham and Staines Electricity Co.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—On the recommendation of the Wolverhampton Corporation E.L. Committee, the following advances in salaries are being made to members of the technical staff: Mr. Stubbs, technical and general assistant, from £160 to £200 per annum; Mr. Dudley, maintenance engineer, £156 to £160; Mr. Bellhouse, boiler house superintendent, £125 to £150; Mr. Forder, engine room superintendent, £120 to £150; and Mr. Platt, junior assistant, £85 to £104, such increases to be retrospective, as from October 1st last.

West Hartlepool Council has appointed Messrs. Rendle and Lindsey, at present acting as shift engineers, as joint station engineers.

Gillingham (Kent) T.C. has appointed Mr. F. Tutt, of Gravesend, and Mr. F. Knell, of Sheerness, as shift engineers at the electric lighting works.

Tramway Officials.—The Tramways Committee of the Sheffield T.C. has recommended that the salary of Mr. A. R. Fearnley, general manager, be increased from £800 a year to £900 forthwith, with four subsequent annual increments of £25 to a maximum of £1,000.

The recommendation of the Oldham Tramways Committee that the salary of Mr. Dugdale, the general manager, be increased from £350 to £400 per annum, was adopted by the T.C. on February 5th by 20 votes to 13.

General.—Mr. H. F. Parshall stated at the half-yearly meeting of the Central London Railway last week that he was retiring from the board to accept the position of consulting engineer to the whole of the Underground interests. During the period in which he has occupied the chair of the Central London Railway, he has acted not only in the capacity of chairman to the railway, but also as managing director and consulting engineer, having, in fact, absolute control of the railway from every point of view. The operating expenses have been largely reduced, and the efficiency of the railway greatly increased. Mr. Parshall, in resigning his position as chairman and accepting the position of consulting engineer to the Underground interests as part of his general practice, is now enabled to give, as formerly, his whole time to his private consulting practice, and to give his undivided attention to the numerous railway and power projects with which he is associated.

Mr. J. W. Buck, late of Messrs. Siemens Bros. Dynamo Works, Ltd., Upper Thames Street, E.C., has been appointed sales manager to the Baldur Engineering and Supply Co., Ltd., of Westminster.

Councillor James Lindsay has intimated his resignation from the convenership of the Leith Corporation E.L. Committee. Mr. Lindsay, it is stated, disapproved of the Committee's action in forming a management sub-committee.

Mr. Bernard L. Myer has resigned the position of chief electrical assistant with Messrs. Sloan & Lloyd-Barnes, consulting electrical engineers, of Liverpool, which he has held for the past nine years, and has taken over the management of the electrical and engineering department of Messrs. Fred. Wilkins & Brother, Ltd., 27-35, Duke Street, Liverpool, who specialise in the electrical, mechanical and fire equipment of theatres and picturedromes, and also carry on a large general electrical engineering business. Mr. Myer invites firms to send him new catalogues and price lists for wiring accessories, motors, cables, conduits, &c.

We learn that the Shanghai municipal electrical engineer will be in this country in June next in connection with orders for two additional 5,000-kw. turbo sets.

At the Tramways and Light Railways Association's convention at Swansea last year, Mr. de Turckheim, the secretary of the Association, was presented with a clock. We are informed that a plate has now been fixed to this clock, bearing the following legend:—

Presented to A. de Turckheim, by the members of the Tramways and Light Railways Association, as a token of esteem and an appreciation of his organising genius.

Swansea, June, 1913.

On Monday evening a gold hunter watch was presented by the staff of Messrs. Crompton & Co., and one or two old Cromptonians, to MR. ALAN WILLIAMS, upon the occasion of his leaving the company's service and starting business for himself. The presentation, which took place at Salisbury House, E.C., in the presence of the staff, was made by Mr. E. Reeves, the joint manager of this company, who wished Mr. Williams all success in his future career. Mr. Williams stated that the handsome present would always remind him of the happy relationship which had existed between himself and the other members of the staff for so many years.

MR. JAMES MEIKLE, electrical engineer, recently of the Glasgow Corporation Electricity Department, has now become associated, as a partner, with the firm of Robert Semple & Co., mechanical and electrical consulting engineers, 30, Buchanan Street, Glasgow, and will be pleased to receive particulars, catalogues, &c., from electrical manufacturers.

MR. H. S. KENNEDY has been appointed to the position of manager of the marine department of Messrs. Siemens Bros. Dynamo Works, Ltd., and will now be stationed in Glasgow. He has been with the firm for a number of years.

Obituary.—MR. GEORGE F. HARDEN.—We deeply regret to learn of the death of Mr. George F. Harden, which occurred on Thursday, the 6th inst., at the very early age of 34. After serving his apprenticeship with Messrs. Scott & Mountain, Mr. Harden joined Messrs. Crompton & Co., Ltd., in 1901, and was later on sent to Glasgow in charge of the firm's branch office there. Subsequently he was moved to a position in the sales department at the head office at Salisbury House, E.C., and finally took over the sales department for the London district. In the beginning of 1912 he was attacked by tuberculosis, and after undergoing open-air treatment, he eventually placed himself in the hands of a specialist in Scotland, under whose care he made a wonderful recovery. Unfortunately, shortly after Christmas he took cold, which went to his lungs, and owing to his power of resistance having been so very much weakened after a year's illness, he was unable to fight the inflammation which was set up in his lungs, and gradually sank and died after three weeks' illness. He leaves a widow and small boy. Both at Glasgow and in London Mr. Harden made a very large circle of friends owing to his genial and breezy manner, and we are sure that this intimation of his death will be received by them with a sincere sense of loss.

A correspondent writes:—"By the death of Mr. Oliver Firth, of Horsforth, Yorks., a gentleman has been removed who was once well known in electrical circles by reason of his connection with the engineering trade and in the manufacture of dynamos."

NEW COMPANIES REGISTERED.

International Cold and Power (Charles Tellier Processes) Co., Ltd. (126,966).—This company was registered on February 4th, with a capital of £24,000 in £1 shares (12,000 preference), to carry on the business of mechanical engineers and constructors, electricians, suppliers of electricity, liquid air, motor or motive power, and artificial cold, ice merchants and manufacturers, refrigerating storekeepers, &c., and to adopt an agreement with E. L. Hieulle. The subscribers (with one share each) are:—W. P. Wethered, 41, Russell Road, Kensington, W., chairman; E. F. Doutre, 56, Moorgate Street, E.C., manager; E. Learoyd, Spencer House, South Place, E.C., secretary; G. A. M. Evans, Woodstock, Broadstairs, retired banker; E. S. M. Perowne, 5, Guildhall Chambers, E.C., solicitor: G. F. Heard, Holmwood, Devonshire Road, Merton, managing clerk: J. Cooper, Rushacre, Goodmayes Vale, Muswell Hill, N., clerk. Minimum cash subscription, seven shares. The number of directors is not to be less than three or more than 12; E. L. Hieulle is the first director; qualification (except first directors), £100; remuneration, 15 per cent. of the surplus profits remaining after payment of a dividend on preference shares, divisible. Registered by E. S. M. Perowne, 5, Guildhall Chambers, E.C.

City of Las Palmas Water and Power Co., Ltd. (126,916).—Registered February 3rd, by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C. Capital, £128,000 in £1 shares. Objects: To supply the port and town of Las Palmas and neighbourhood with water and electricity, to acquire the concession granted to Bernardo de la Torre by the Municipality of Las Palmas, Grand Canary, and to adopt an agreement with the Las Palmas Syndicate, Ltd., and the Bernardo de la Torre. The signatories (with one share each) are:—J. Barnes, 7, Walcot Gardens, Kennington, S.E., accountant; W. R. Tompkins, Morecroft House, 100, Brompton Road, St. Albans, clerk; C. Anning, Ellerslie, Sylvan Road, Snaresbrook, clerk; W. R. Smith, 6, Lawley Street, Lower Clapton, N.E., clerk; A. G. Mount, 88, Narford Road, Clapton, N.E., clerk; E. J. Burrows, 44, Hersham Road, South Tottenham, clerk; S. A. Sharpe, 205, Friern Road, Dulwich, S.E., cashier. Minimum cash subscription, two shares. The first directors (to be not less than three or more than seven) are to be appointed by the signatories; qualification, £250; remuneration, £200 each per annum (chairman, £250), and 7½ per cent. of the surplus profits available for distribution after 5 per cent. dividend is paid.

Havana Development Syndicate, Ltd. (127,068).—This company was registered on February 8th, with a capital of £21,000 in 20,000 ordinary shares of £1 each and 20,000 deferred shares of 1s. each, to promote any company for the acquisition of all or any of the property, rights and liabilities of the company, to construct, equip, maintain and work steam electric, or motor railways, tramways, omnibuses, or other vehicles for the carriage of passengers and goods, &c., in Cuba or elsewhere. The subscribers (with one share each) are:—L. A. Bartlett, 53, Camilla Road, Bermondsey, S.E., secretary; J. A. Mattana, 7, Lordship Park, N., secretary. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; qualification, 50 shares: remuneration, £50 per annum. Registered office, 1, London Wall Buildings, E.C.

Bootle Electrical Co., Ltd. (126,985).—This company was registered on February 5th, with a capital of £1,500 in £1 shares, to take over the business carried on by T. P. Taylor, at 28A, Oriel Road, Bootle, as the "Bootle Electrical Co." The subscribers (with one share each) are:—T. P. Taylor, 28A, Oriel Road, Bootle, electrical engineer; D. Brown, 41, Pembroke Road, Bootle, ironfounder and engineer. Private company. The number of directors is not to be less than three or more than five. The first are T. P. Taylor, D. Brown and R. Tilley; qualification, 50 shares. Registered office, 28A, Oriel Road, Bootle. Solicitors, Ashby & Clothier, 8, Cook Street, Liverpool.

Leeds Private Telephone (New System) Co., Ltd. (126,997).—This company was registered on February 5th, with a capital of £1,000 in £1 shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—F. T. Jackson, 143-5, Great Portland Street, W., agent; T. H. Walker, 57A, Holborn Viaduct, E.C., printer. Private company. The first directors are F. T. Jackson (permanent chairman and managing director) and T. H. Walker. Registered office, 2, Basinghall Square, Leeds.

Refilments, Ltd. (127,002).—This company was registered on February 5th, with a capital of £3,000 in £1 shares, to carry on the business of manufacturers and producers of electric-filament lamps, &c. The subscribers (with one share each) are:—W. Lee, 23, Blenheim Road, Bedford Park, land agent; C. B. James, Holme House, Norbury, accountant. Private company. The number of directors is not to be less than two or more than eight; the first are not named; qualification, £100; remuneration as fixed by the company. Registered office, 60, Haymarket, S.W.

CITY NOTES.

Mersey Railway Co.

THE half-yearly ordinary general meeting was held on Tuesday, at the offices, Worcester House, Walbrook, E.C., Mr. J. Falconer, M.P., in the chair.

The CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., page 231), said it was a great satisfaction to the board to be able at the end of the half-year to again record that substantial progress had been made by the company as regarded its volume of traffic, its receipts, and also its net revenue. That steady increase in those three particulars had been maintained ever since they had adopted electrical traction for the line. It was now practically 10 years since they first commenced electrical working, and during that time the receipts had increased practically to the extent of £60,000 per annum. Their receipts during this last year were practically £60,000 more than they were in 1902, which was the last complete year of steam working. Comparing the last half-year of steam working with the half-year under review, it would be found that the number of passengers carried had increased from 3,500,000 to 8,111,000, an increase of 4,750,000, or 141 per cent. The receipts had increased from £29,470 to £59,651, an increase of £30,000, equal to 102 per cent. It was interesting to compare the figures for the past year with the corresponding period of 1911. It was true that there was a strike in 1911, but it was satisfactory to note that the passengers carried, apart from season ticket-holders, were 12,745,000, as against 11,940,000, which was an increase of about 6·72 per cent. The receipts had increased from £109,947 in 1911 to £115,926, equal to about 5·44 per cent. The expenditure had only increased from £59,415 to £60,765, an increase of £1,315, which was almost entirely due to an increase in the price of coal. The net revenue had increased from £50,532 in 1911 to £55,158 in 1912, an increase of £4,626, or 9·15 per cent. The important question for the debenture-holders was as to the amount available for payment of interest upon the debentures. After providing the full payment of the interest on the first debenture stock amounting to £26,774, there remained £18,060. That was sufficient to pay the interest on the 1866 stock in full, and also on the 1871 stock and to pay £2,179 per cent. upon the 1882-3-5 3 per cent. stock, or within 2/3 per cent. of the full amount to which that stock was entitled. He thought the shareholders and debenture-holders would agree that it was gratifying that they should have been able to pay the interest upon those debenture stocks in the way they had. They still had the "B" debenture stock to face before they reached payment upon the preference shares. The amount of that stock was £282,354, and the amount required to meet the interest, which was 3 per cent., was £8,470. The length of time which it would take before they were in a position to pay interest upon that stock would, of course, depend upon the rate of progress they made in the future. It had never been their habit to attempt to prophesy—all he could say was that every year had confirmed the board in the view that there was a great volume of traffic to be served by the railway, and that they had adopted the right policy in giving what they thought was the best railway service in the United Kingdom.

The HON. R. C. PARSONS, M.A., seconded the motion.

Replying to questions, the CHAIRMAN said that during the month that had elapsed since the accounts were closed, the returns showed further reasonable expansion. They had no reason to believe that the limit of expansion had been reached, and the shareholders were in quite as good a position as the board to form a judgment on that matter. They could do a very largely increased traffic with comparatively very little additional capital expenditure. The generating plant was more than ample for any expansion of traffic which was likely to come for a considerable time.

The report was adopted.

W. T. Henley's Telegraph Works Co., Ltd.—Subject to audit, the directors have decided to recommend a dividend payable on March 1st next, on the ordinary shares at the rate of 15 per cent., free of income-tax, including the interim dividend of 5 per cent. paid August 31st last.

South Metropolitan Electric Light and Power Co., Ltd.—The transfer books and register of members will be closed from February 15th to 28th, for the preparation of warrants for dividends payable on 28th inst.

Newcastle and District Electric Lighting Co., Ltd.—The directors recommend a final dividend of 3 per cent. for the last half of 1912, making 3 per cent. for the year.

Underground Electric Railways Co. of London, Ltd.

The directors report that for the half-year ended December, 1912, the net revenue from investments and properties (including general interest), after deducting general expenses and including balance brought forward, amounted to £278,007, and the interest charges on £1,730,000 4½ per cent. bonds of 1933, absorbed £41,336, leaving a surplus of £236,671. Out of this will be paid on March 1st, 1913, interest at the rate of 6 per cent. per annum on £1,273,000 6 per cent. first cumulative income debenture stock for six months ending December, 1912, £38,190; interest at the rate of 6 per cent. per annum, plus income-tax, on £6,136,050 6 per cent. income bonds of 1948 for six months ending December, 1912, £195,485, carrying forward £2,996. The income for the half-year shows an increase of £122,671 over that for the corresponding half-year of 1911, but a true comparison is not possible on account of the substantial alteration in investments.

The Metropolitan District Railway Co. continues to show a steady expansion in receipts, with a slight increase in working expenses, due largely to the increased price of coal and to increases in the wages of the staff.

The London Electric Railway Co. shows an increase in earnings and also in working expenses, the latter due to higher prices of coal and increase in the wages of the staff. The construction of the Charing Cross and Paddington extensions is progressing rapidly, and it is expected that both will be opened for traffic in the autumn. Work has also been commenced on the Queen's Park extension, and on the installation of escalators at Oxford Circus Station.

The London General Omnibus Co., Ltd., has substantially increased its fleet of motor-omnibuses, and shows a satisfactory expansion in earnings.

The Associated Equipment Co., Ltd., has been formed for the purpose of manufacturing equipment and repair parts for the various undertakings allied with the company. It owns a large factory at Walthamstow, to which extensive additions are being made. It also owns all the debenture stock and ordinary shares of the Metropolitan Steam Omnibus Co., Ltd.

The annual report and accounts of the London United Tramways, Ltd, for 1912 are not yet published, but it is not expected that the results of the year's working will show much, if any, improvement over the previous year.

After giving particulars of Parliamentary Bills, the report goes on to refer to the amalgamation or consolidation schemes entered into with tramway and omnibus companies, and certain underground electric lines.

In the balance-sheet "stocks, shares, and other property," stand in the books at £13,502,622, and consist of stocks and shares in associated companies, as well as lands and buildings.

The item "calls unpaid," which formerly appeared in the balance-sheet, has been eliminated, as all of the capital has been paid up. Most of the securities and shares of the company are now held by British investors. In view of this fact, the American directors have come to the conclusion that the management of the company should in future be wholly in the hands of the board of directors residing in Great Britain. They have therefore resigned their seats, and Mr. W. M. Acworth and the Right Hon. C. B. Stuart-Wortley, K.C., M.P., have been elected to the board. In parting from their American colleagues, the directors desire to express their high appreciation of the valuable services rendered by them to the company in the past.

The meeting is called for February 24th.

Central Electric Supply Co., Ltd.—In their annual report, the directors state that an agreement for the supply in bulk under the London Electric Supply Act, 1908, has been entered into with the Chelsea Electricity Supply Co., Ltd. Energy has been supplied to the Westminster Electric Supply Corporation, Ltd., the St. James's and Pall Mall Electric Light Co., Ltd., and the Chelsea Electricity Supply Co., Ltd., to an amount of 24,328,750 units. After making a full allowance for sinking fund and depreciation, the net balance for 1912 is £4,999, plus £5 brought forward, leaving to be dealt with £5,004. A dividend at the rate of 5 per cent. on the ordinary shares for the year absorbs £5,000, leaving £4 to carry forward. A 3,000-kw. high-pressure turbo-generator has been added to the plant during the year. Mr. Marlborough R. Pryor has been appointed a director of the company.

The Promotion and Flotation of Limited Companies.—According to a lecture delivered on the 11th inst. in the City by Mr. H. W. Jordan, F.I.D., an advance print of which was sent to us, it would appear that out of 138,000 companies registered under the 1862 Act, some 80,000 have become defunct, leaving, approximately, 58,000 with a paid-up capital of about £2,450,000,000. In 1912, 7,666 companies were registered representing a capital of £173,819,037. Commencing with a brief sketch of the history of companies, the lecturer discourses pleasantly upon various matters under such titles, *inter alia*, as "purpose of formation," "freak companies," "invalid articles," "formation" (steps to be taken on the registration of a company), but the paper is obviously not intended for the professional secretary, whose varying and onerous duties and responsibilities, by the way, are ever on the increase. Though many improvements have been effected in the Companies' Acts, now codified under the name of "The Companies' (Consolidation) Act, 1908," there seems, in many cases, to be room for a greater pressing home of the all-important element of responsibility in accepting and dealing with public money.

Electrical and Industrial Investment Co., Ltd.

The report of this company for the seven months from June 1st to December 31st, 1912, as published in the financial Press, states that the company was capitalised mainly by debenture-holders and shareholders of the City of Birmingham Tramways Co. subscribing for debenture stocks and shares in this company, under a scheme of conversion by which this company acquired the investments of that company, comprising, among others, a large proportion of trustee securities. A reserve was provided in securities by that company to meet the depreciation of the trustee securities and of some of the other investments taken over. All the trustee securities and some of the others have since been realised, and the loss on realisation has been borne by the reserve. The directors have acted on, and propose to adhere to, the principle of adding to the reserve any profits made on sales of any of the company's investments, and of charging against the reserve any losses on realisation. The balance account at December 31st, 1912, was £23,195. The directors have power to issue debenture stocks to an aggregate amount not exceeding the subscribed share capital of the company, and they propose to issue further debenture stocks of the company accordingly. The revenue account shows a profit, after paying all administration expenses, of £11,325. The interest on the debenture stocks amounts to £2,970, and the dividend on preference shares to £3,411, leaving £4,943. This balance would admit of a dividend on the ordinary shares at the rate of 4¾ per cent. per annum. The directors, however, are of opinion that it is better to strengthen the company by defraying the whole of the preliminary expenses, amounting to £1,629, out of the first profits, carrying forward the balance of £3,314.

Mather & Platt, Ltd.—The directors announce a dividend at the rate of 10 per cent. per annum, with a bonus of 2 per cent., both free of tax, less the interim dividend of 5 per cent. already paid.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Manaos Tramway and Light Co., Ltd.—300,000 ordinary shares of £1 each fully paid, Nos. 1 to 300,000 (special application).

Pacific Power and Light Co.—$5,605,000 5 per cent. first and refunding mortgage 20-year gold bonds, International series, Nos. 1 to 5,295 and 5,301 to 5,610 of $1,000 each.

Sao Paulo Electric Co., Ltd.—£1,880,000 5 per cent. 50-year first mortgage bonds, in lieu of the scrip.

The Committee have appointed a special settling day as under:—

Wednesday, February 19th.—Universal Cheap Cables, Ltd.—20,000 shares of £1 each fully paid, Nos. 1 to 20,000.

And ordered the undermentioned securities to be quoted in the Official List:—

Commercial Cable Co.—£14,146 additional sterling 500-year 4 per cent. debenture stock.

Chloride Electrical Storage Co., Ltd.—The directors recommend, out of the undivided profits, an interim bonus of 7s. 6d. each on the ordinary shares, to be satisfied by the issue and *pro rata* allotment of 19,344 new shares, making 73,250 of these shares outstanding.—*Financial Times.*

Telegraph Construction and Maintenance Co., Ltd.—In addition to the interim dividend of 5 per cent. paid in July last, there is announced a further dividend of 10 per cent., together with a bonus of 12s. per share, making 20 per cent. for the year. This compares with 17½ per cent. for 1911.

Blackpool and Fleetwood Tramroad Co.—The half-yearly meeting was held at Manchester on Tuesday, Mr. Geo. Richardson presiding. The chairman said that the result of the half-year's working was very satisfactory, especially considering the state of the weather.

Willans & Robinson, Ltd.—The report states that the accounts for the year to June 30th show a balance against profit and loss of £52,191, of which £31,310 represents book adjustments, the result of a special scrutiny of fluctuating assets instituted by the directors when the bank loan was arranged. The balance of £20,881 represents the trading loss for the year after including provision of £8,337 for depreciation, £9,378 for debenture interest, and £892 for the upkeep of Queen's Ferry Works, a total of £18,607.—*Financier.*

Dublin United Tramways Co. (1896), Ltd.—The directors report that the accounts for the half-year to December 31st show available for division £63,852. It is recommended that dividends be paid for the half-year at the rate of 6 per cent. per annum (less income-tax) on both the preference and ordinary shares. £10,000 is to be set aside towards the renewal of permanent way, £2,000 to accident insurance reserve, and £5,000 to reserve and renewals fund, leaving £11,257 to be carried forward.

Prospectus.—*Hydraulic Power and Smelting Co., Ltd.*—There has been offered for subscription this week (the list was to close last Tuesday) an issue of £475,000 5 per cent. first mortgage debentures at 95 per cent. in this company, which was formed in 1911 to acquire the share capital of the following companies:—Aktieselskabet Tyssefaldene; Norsk Elektrisk Metalindustri Aktie selskap; Trollhättans Elektrothermiska Aktiebolag.

St. James's and Pall Mall Electric Light Co., Ltd.

THE directors' report for 1912 shows that the connections have increased from 13,975 KW. to 14,609 KW., and 11,044,768 units were supplied to consumers. The Central Electric Supply Co., Ltd., has declared a dividend of 5 per cent. on the ordinary shares, in respect of which a sum of £2,500 will in due course be payable to this company. As stated in last year's report, it is intended to continue the equipment of the Carnaby Street works with transformers and accumulators to deal with an increase in H.T. supply from the Grove Road works. To meet the consequent obsolescence of steam generating plant, special provision for depreciation has again been made in 1912, and the directors have also carried a sum of £4,500 from net revenue account to the credit of contingency fund. The net profits for 1912, applicable to dividends on shares, amount to £26,946, plus £2,294 brought forward, less interim dividend paid in August last for half-year ending June 30th, at the rate of 7 per cent. on preference shares, £3,500, and 10 per cent. on ordinary shares, £10,000, leaving £15,740 to be dealt with. It is proposed to pay a dividend at the rate of 7 per cent. on the preference shares for the second half-year, requiring £3,500, and a dividend on the ordinary shares for the second half-year of 5s. per share, making, with the interim dividend paid in August last, a total of 10 per cent. for the year, £10,000, leaving £2,240 to carry forward. The directors regret the death of Sir John H. Morris, K.C.S.I., and they have elected Mr. F. J. Walker to a seat on the board, and have appointed him managing director of the company.

The meeting is called for February 18th.

Units generated and purchased	13,909,052
Quantity utilised—Private supply	11,044,768
Used on works	372 353
Total	11,417,121
Expended in distribution	2,491,931
Total connections in KW., December, 1912	14,609

Central London Railway Co.

THE meeting of this company was held on February 6th at the Holborn Restaurant, Dr. H. F. Parshall presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 231), said that during the half-year the expenditure on capital account had been £53,148, chiefly in connection with the Liverpool Street extension, which alone had amounted to £37,941. The estimated expenditure on the Liverpool Street extension during the present year was £44,000, and for subsequent years £1,000. On the Ealing and Shepherd's Bush extension, the estimated expenditure for the present year was £61,000, and for subsequent years £30,000, and that together with the provision for additional rolling stock £6,000, and an amount for subsequent years of £69,000, gave a total of £211,000. To meet the anticipated capital expenditure, they had unissued debenture stock, amounting to £160,000, and a balance at the credit of capital account of £112,978, a total of £272,978. They had carried 18½ million passengers, which, as compared with the same period of last year, showed an increase of 613,000, and the increase in receipts amounted to £5,222. That, together with the increase in miscellaneous receipts, gave a total increase in receipts of £5,903. Against that, there was an increase in working expenses of £2,632, principally accounted for by the extra cost of working the Liverpool Street extension. It would be seen, therefore, that the net revenue showed an increase of £3,271. It was very satisfactory to note that the Liverpool Street extension, which was opened on July 29th last, had contributed mainly to that increase in passengers and receipts. The actual bookings at Liverpool Street for the five months preceding the date of the balance-sheet accounted for 1,626,000 passengers, with £10,200 receipts. The Broad Street portion of the extension, which was opened on October 10th last, had contributed 161,000 passengers, with £1,184 receipts. That gave a total for the extension of £11,384. A great increase in the Broad Street traffic was anticipated as soon as the lifts were ready for use. They had already been tested, and would be expected to be running in ten days. The gross receipts for the half-year amounted to £144,455, as against £138,552, and after deducting working expenses, which amounted to £76,328, there was a balance of net revenue of £68,127. That compared with £64,856 for the corresponding period of the previous year. The amount brought forward from last half-year was £23,776, general interest amounted to £6,530, and the amount reserved from the last half-year to meet the dividend of the deferred stock was £6,462, giving a total net revenue of £104,895. After providing for debenture interest and other payments amounting to £19,475, there was an available balance of £85,420, as compared with £83,170 last year. The interest on the 4½ per cent. preference stock amounted to £10,800, less amount charged to capital under the Act of 1909, £4,060. There was, therefore, a total balance available of £78,680, and from that sum dividends on the undivided ordinary stock at the same rate as last year, namely, 3 per cent., and of 4 per cent. on the preferred ordinary stock and 2 per cent. for the whole year on the deferred stock, were recommended, absorbing £51,462. That left a balance to be carried to the next half-year of £27,218, as against £26,151. The whole of the permanent way was being renewed, and a system of automatic signalling was being installed; all of this work was well in hand and was being proceeded with as rapidly as possible. Proceeding to refer to the recent proposals of the Underground Electric Railways Co. of London, Ltd., which were fully explained at a meeting of shareholders in December last, he said that holders of over 75 per cent. in the aggregate of the ordinary, preferred ordinary, and deferred ordinary stocks, had accepted that offer, and the Underground Co. had intimated that the offer was now binding upon them. Under the trust-deed between the Underground Co. and Messrs. Glyn, Mills, Currie and Co. and two of their directors, namely, Viscount St. Aldwyn and Sir H. Babington Smith, remained on the board to represent the interests of the guaranteed stockholders; the Hon. A. H. Mills also remained as a director. Mr. R. Fleming, Lord Knollys and Lord Rathmore, had retired, and Lord George Hamilton, Sir Herbert Jekyll and Mr. Albert H. Stanley, having been nominated by the Underground Co., have been elected in their places. In accordance with the new arrangements, his own resignation had been tendered to take place after the meeting, when it was proposed to elect Lord George Hamilton as the new chairman.

VISCOUNT ST. ALDWYN seconded the motion, and the report was adopted.

Smithfield Markets Electric Supply Co., Ltd.

SIR H. S. LEON, Bt. (chairman), presided on Friday at Winchester House, E.C., over the fifteenth ordinary general meeting of the above company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 234), said that £2,847 had been spent on capital account during the year. This included a part of the cost of the new generating plant, and since their report had been issued, three of these new machines had been brought into use, so that the balance of the cost when the fourth one was erected would be charged to the capital account of 1913. Last year he alluded to what were termed physical difficulties on account of the Diesel engines, but those difficulties had been surmounted, and it was hoped that, if all went smoothly, their income would be considerably increased as the result of this heavy expenditure. Turning to the revenue account, it showed a small increase in the gross profit. There had been some money spent out of revenue on improvements of a special nature in connection with their installations entirely for the benefit of their customers, which had already proved itself very well spent. The gross revenue showed a slight falling off, almost entirely due to a smaller demand for power, perhaps on account of the cold summer. It would also be remembered that the Dock strike of last summer dislocated trade and injured the particular business from which they derived some part of their revenue. Their competitors, the gas company, had been very active in the markets, and it spoke well for the popularity and manifest advantages of electric lighting that they had so far been able to hold their own. It seemed to him remarkable that anyone could prefer gas to electricity, even if they had to pay double the price for electricity. The net profit was equal to 6 per cent. more than last year, after having placed £400 to the debenture stock redemption fund, and £500 to depreciation account, while the amount available for dividend was £2,154. The board, therefore, recommended the payment of a 2 per cent. dividend, the same as last year. They might have to borrow a little money to pay for the new plant, but the board intended this debt to be only of a temporary nature, and repayment of it would be made as the company could afford to do so. He desired to emphasise the importance of having a considerable sum in cash as working capital, for they must be in a financial position to face the gas competition as well as to effect any improvements which might come along, so as to reduce the cost of generation. As a matter of fact, they had had an increase in the number of lamps installed last year, in spite of the gas competition, but the revenue from them was not so large, owing to the varying conditions of trade in the market. The electric lighting bills of their customers were much more closely examined than they used to be, and while the aggregate of trade was larger, the profit was smaller. He thought that was the general tendency of trade in every branch throughout the country, and in the long run he did not think it would do any damage to them or anybody else.

MR. E. SCHENK seconded the motion, and the report was adopted without discussion.

Official Announcements re Companies.—The following are to be struck off the register within three months, unless cause is shown to the contrary:—

Bartitsu Light Cure Institute, Ltd.
Carnarvonshire Electric Traction Syndicate, Ltd.
Empire Electric Light and Power Co., Ltd.
Improved Electric Supplies, Ltd.
Ozonisation Syndicate, Ltd.

National Gas Engine Co., Ltd.—The directors report that for the year 1912 the net profit, after providing amply for depreciation of buildings, tools, &c., and allowing for management salaries and income-tax, was £91,238. An interim dividend for the six months to June 30th, amounting to £28,500, being at the rate of 5 per cent. per annum on the preference shares, and 7½ per cent. per annum on the ordinary shares, was paid on July 31st, 1912, leaving £62,738 plus £5,769 brought forward, making £68,506 to be dealt with. The directors recommend a final dividend at the rate of 5 per cent. per annum on the preference shares, and 7½ per cent. per annum on the ordinary shares, both less income-tax, for the six months ended December, 1912. This will absorb £28,500, and leave £40,006, out of which the directors propose to place £21,200 to the reserve fund (making it £30,000), to write off the formation expenses £8,867, and to carry forward £9,939. Mr. Kenneth S. Prescott has been elected to the board.

Bristol Tramways and Carriage Co., Ltd.

The directors' report for 1912 shows that the gross receipts were £369,614, and the working and general expenses and renewals £301,412, leaving a net revenue of £68,202. From the net revenue the following have been distributed, viz., interest for the year on 4 per cent. and 4½ per cent. mortgage debenture stock, and on deposits and bankers' interest, £23,860; interest (carried to reserve fund) on investments realised for capital outlays, £2,593; dividend on 4 per cent. preference shares for the year (subject to income-tax), £18,833; interim dividend at the rate of 4 per cent. per annum (subject to income-tax), for the half-year ended June 30th, £9,417; and it is proposed to appropriate the balance as follows:—Final dividend for half-year at the rate of 4 per cent. per annum (subject to income-tax), £9,417; addition to reserve fund for contingencies and renewals, £4,083. The interest on investments, and amounts from income-tax claims adjustment, have been carried direct to the credit of the reserve fund, which totals £241,289. With the addition now proposed of £4,083, the reserve fund will be further augmented to £245,372. The receipts from the tramways department show an increase of £5,390, or about 2½ per cent., whilst those of the carriage department have increased by £27,666, or 26 per cent. The total number of passengers carried during the year on the company's cars and motor-omnibuses was 52,370,515, as compared with 49,561,001 in the previous year, an increase of 2,809,514.

The expansion of the company's general motor carriage business is continuous. The business at the branches in Bath and Weston-super-Mare is increasing daily, and further developments are intended; moreover, the branch established during the past year at Cheltenham has succeeded in fulfilling the public requirements so admirably, that another one will be forthwith opened in the adjoining city of Gloucester. The company have recently been appointed by H.M. Postmaster-General as contractors for the carriage of the mails by motor vehicles for three services, between Gloucester and Bath, Cardiff and Birmingham respectively, and a further service between Bristol and Chipping Sodbury. This is in addition to the contract for Bristol local mails held for years past by the company. New motor-omnibus routes will be opened in and around Bristol, whilst the daily excursion traffic for Bristol and the West of England will be further developed in the ensuing summer. Fifty high-class cars for private hiring are being built at the company's works, and will shortly be added to the stock. An additional number of commercial vehicles will also be provided to meet the increasing demand. The motor building and repairing works at Brislington (covering upwards of four acres) are partially occupied, and will be completed in June next. The installation, comprising machinery and automatic tools of the most recent invention, is designed to yield an output of about 300 new motor-omnibuses, cabs and other vehicles each year, as well as to enable all repairs to the company's rolling stock and privately-owned cars to be executed under most economical conditions. During the past year the directors have purchased, for the sum of £1,500, the undertaking of the Clifton Rocks Railway Co., constructed at a cost of £30,000. The railway can be profitably worked by the company and made available as a convenient link for those passengers who travel by the vehicles now or at any future time to be worked by the company in and around Clifton and Hotwells.

The recent Insurance Act received much consideration by the directors, who found that if the company elected to carry out the literal requirements of the Act, the employés would be injuriously affected, and placed in a much inferior position to that they had occupied under their provident society, which had been fostered by the company for many years past. The directors, therefore, formulated a scheme for an "Approved Society," embracing only the company's employés, and this received the immediate and hearty approval of the Insurance Commissioners. Occasion was taken to still further enlarge the benefits so that the employés are now secured such advantages as are enjoyed by few, if any, similar employments in the kingdom.

The Employés' Superannuation Fund, wholly subscribed by the company and its directors, now amount to £29,115. The substantial provision now existing, and which will continue to be made for old age or other incapacity, is much appreciated by the employés.

The meeting is called for February 19th.

Paisley District Tramways Co.

The directors' report for the half-year ended December 31st, 1912, shows that the revenue was £30,056, and the expenses were £17,622, leaving £12,433; less general interest, £265; interest on debentures, £1,600; debenture sinking fund, £750, leaving £9,818, plus £1,996, brought forward, making a balance of £11,814. Out of this, £3,000 has been placed to general reserve account; £3,750 to dividend for the half-year on the 5 per cent. cum. pref. shares; £1,000 to preference share sinking fund; £1,620 to dividend at the rate of 2 per cent. per annum for the half-year on the ordinary shares; £2,444 being carried forward. The traffic receipts show an increase of £1,113 and the expenses an increase of £1,794, as compared with the receipts and expenses for the corresponding half-year of 1911. The increase in expenses was mainly due to running additional services, heavier charges for maintenance and for local rates. Four additional cars were purchased during the half-year.

Half-year ended.	Miles open.	Passengers.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
June, 1911 ..	17·98	6,009,072	£26,120 19 2	1·04d.	559,021	56
Dec., 1911 ..	17·98	6,487,088	28,786 4 11	1·06d.	608,502	56
June, 1912 ..	17·98	6,597,579	28,479 17 4	1·04d.	619,850	56
Dec., 1912 ..	17·98	6,862,083	29,849 11 9	1·04d.	644,478	60

City of Buenos Ayres Tramways Co. (1904), Ltd.—

The directors' report states that the annuity payable by the Anglo-Argentine Tramways Co., Ltd., has been received, and the net revenue for the year to December 31st amounted to £66,592. Interim dividends have been paid for the nine months ending September 30th, absorbing £46,500, leaving a balance of £20,092. The directors recommend (says the *Financier*) that a final dividend of 1s. 3d. per share (making 5s. per share—5 per cent. per annum—less income-tax) be paid for the year, absorbing £15,500; that £4,500 be transferred to general amortisation fund, and £92 carried forward.

Northampton Electric Light and Power Co., Ltd.

The report for 1912 says that the company's undertaking is making satisfactory progress. Lamps and motors have been added (to the equivalent of 20,426 32-watt lamps), making a total equal to 145,587 lamps. The increase in H.P. of motors is 563, making a total of 2,725 H.P., and of this 2,280 are hired from the company. The mains added were 1 mile 671 yards in extent, making a total of 29 miles 1,648 yards. In addition to this, new feeder ducts have been laid in various directions, the increase amounting to 2 miles 311 yards. The output of electricity has been 3,108,113 units, compared with 2,497,871 in the previous year, being 25 per cent. increase. The maximum load on plant was 1,956 KW. (25 per cent. increase) and the load factor 18·1. The coal strike occasioned some additional expenditure for fuel. There has been a reduction in the price of current for lighting. Eight cottages in Fetter Lane, adjoining the company's property, have been purchased. A considerable addition to the generating plant will be made during 1913, and to meet the cost of this a further issue of debenture stock is contemplated. The general depreciation account has been increased by £5,200 (out of which certain specific items have been written down, as shown by the balance-sheet), also £375 has been written off motors, and £1,500 added to reserve. The sum of £750 will be required for the dividend on the 5 per cent. preference shares, and the directors propose that 7 per cent. per annum should be paid on the ordinary shares for the half-year (making 6 per cent. for the year), absorbing £2,450, leaving £2,048 to be carried forward.

Electrical Distribution of Yorkshire, Ltd.

The directors report that the accounts for the year 1912 again show steady and satisfactory progress. The net profit for the three years ending December 31st is as follows:—1912, £1,903; 1911, £1,347; 1910, £515. The profits up to the end of 1911 enabled the company to write off formation, preliminary and working expenses amounting to £428, to pay a dividend at the rate of 4 per cent. per annum, and to carry forward £349, which, added to the profit for 1912 of £1,903, makes a disposable balance of £2,252. The directors recommend a dividend, free of income-tax, for the year 1912 at the rate of 6 per cent. per annum on the ordinary shares, amounting to £1,104, putting to reserve £600, making it £1,000, carrying forward, subject to any remuneration voted to the directors, the balance of £548.

Applications were made to the Board of Trade for provisional orders for electric lighting in Ardsley, Darton and district, Goole and district, Rothwell and district, and Wombwell and Worsborough. All these Orders have now been confirmed by Parliament. During the year there has been a steady growth in the use of the company's supply, and a large number of consumers have been added, and further demands for energy continue to be received.

Applications for 3,135 ordinary shares of £1 each have been received during the year. Only £4,865 of the authorised capital remains unapplied for. In order that shareholders may have the first opportunity of taking this up, an application form is enclosed with the report. In order to provide for extensions in the districts in which a supply is now being given, and to commence the development of the new districts before referred to, further capital is required. An extraordinary meeting will be held on February 25th for the purpose of increasing the nominal capital of the company from £25,000 to £50,000 and the borrowing powers from £5,000 to £10,000.

The directors report the death of Mr. John Nevin, a director from the inception of the company.

The meeting will be held on February 25th at Leeds.

STOCKS AND SHARES.

Tuesday Evening.

It is certainly true to say that there is very little business doing round the Stock Exchange as a whole. None of the markets are anything like active, and what trade comes in is mostly of the patchy order. Dear money; new issues; foreign politics; booming trade; these are some of the considerations which militate against the Stock Exchange, and for the time being there seems to be little indication of conditions altering. The first relief is expected to come from the Near East, but even there the belligerents are putting up a more strenuous fight than anybody thought they would do.

Amongst the new issues which fall naturally into the markets these notes are concerned with, is one that will, perhaps, make its appearance within a few days—if it is not already out before we are. The emission will probably take the shape of 5 per cent. Debentures in the Las Palmas Water and Power Company; and the last proof prospectus which we saw of this bears date September 2nd, 1912. Particulars are available of the coming issue of the Cedar Rapids Manufacturing and Power Company, which is to be offered to the holders of the Montreal Light, Heat and Power and the Shawinigan Water undertakings. Eight and a-half million dollars of 5 per cent. Cedar Rapids bonds are to be offered at 90, with a bonus of 25 per cent. in common stock.

The Railway market suffers from neglect. A good deal of attention is being turned to the stocks of the trade lines in consequence

of the unexpectedly good dividends just declared, and interest in Undergrounds has abated correspondingly. Metropolitans are ¼ higher; Districts ½ down. London United Tramways Preference dropped to 4⅛, and a rally to 5 leaves them 10s. down on the week. Underground Electric 1s. shares braced up to 14s. 4½d., which is not quite so good as they were a fortnight ago. The Ordinary fell to 4⅛, the report, out this week, being considered rather disappointing. Great Northern and City Preferred shares recovered ⅛ after their fall of ½ last week, for it is now supposed that the scheme for absorption of the Tube by the Metropolitan Company will be duly confirmed. Shrewd opinion looks for the Great Western to enter into a much closer working alliance with the Metropolitan than is already the case; and should this come about, it would naturally add strength to the position of the Underground Railway. Central London issues are unchanged, and City and South London remains at 38. The City Company's Preference stocks have all shed 2 points, while the 4 per cent. Debenture crumbled to 98, these movements being in company with a variety of falls that have taken place amongst Home Railway pre-ordinary stocks during the past week.

British Electric Traction stocks have eased off to some extent, and Metropolitan Electric Trams Ordinary are flat at the nominal price of 31/32. There is little market left in these, for the Company is becoming merged virtually into the London and Suburban, the Ordinary shares in which are quoted at 7s. 6d., while the Preference are 13s. East London Ordinary stock is a better market at 9⅝.

English Electricity Supply shares are somewhat featureless, but it is worth noticing that City of London Ordinary are up a further 5s. to 17¾, the rise being accompanied by rumours—as vague as ever—that something was "up" besides the price of the shares. The tip goes round that Cities are remarkably cheap at 18½, but we heard the same thing repeated with, if anything, rather more emphasis when Cities stood at 23. St. James's Ordinary eased off ⅛ on the report, which shows the net profit to be a little less than that for the previous 12 months. Smithfields have been offered, and the price slumped from 32s. 6d. to a sovereign, the dealers being anything but anxious to buy the shares. Several lines of South London Ordinary shares have changed hands within the last few days, and there are speculative investors who regard the shares as cheap, having regard to the position of the Company and the return which is available from the shares.

Mexico City is said once more to be in the throes of revolution, and, by reason of this, most of the stocks and shares which have any connection with Mexico have given way. Mexican Light and Power Common stock fell 2, Monterey bonds 1, Mexico Trams 1½, the bonds ½ to 1, and so on. There was not a great pressure to sell, quotations being marked down more as a measure of precaution than as a reflection of sales. Rio Seconds are lower to the extent of ½. Brazilian Traction Common shares dropped to par. British Columbia Deferred is a point lower; and Shawinigan Water, now that the Cedar Rapids scheme is out, fell 4 points to 146 middle, Montreal stock retaining its high figure. The Anglo-Argentine group is steady, but the First Preference, at any rate, can be bought more cheaply than the official quotation would seem to indicate: since the actual price at the time of writing is 4 3/32—4 3/32, it appears an absurdity to quote it as 4⅞—5⅛ in the Stock Exchange Official List. City of Buenos Ayres Trams are a shade harder, and Para Debenture stock improved slightly.

The excitement in connection with Marconis has been less evident, though there is plenty going on still in the shares. The price keeps most of its last week's rise, and Canadians shot up to 18s. 6d. bid before reacting a few pence. Americans and Spanish have been better in sympathy. So far as can be ascertained, the market impression prevails that if the Company were able to nullify the agreement with the Government, it would be in a position more favourable for securing good terms. Meanwhile, the evidence being given before the Commissioner is followed with the keenest interest.

National Telephone Deferred shrinks continually, last week's recovery being but a check to the steady fall. The price has dipped to 92½, and as the Company's books close finally on the 25th inst., the time should not be far off when all doubts are set at rest as to what proprietors of National Telephone Deferred stock are likely to get in exchange for their present holding. The secretary wrote to the Stock Exchange authorities the other day, however, saying that he could assign no definite date when the information would be available. The matter, of course, rests in the hands of the Post Office, because the latter has appealed against part of the recent award. Outside Marconis and National Telephones, the market is idle and stagnant. Anglo-American Deferred fell 3/16, and Commercial Cable 4 per cent. Debenture has moved on to a basis of 5 per cent. return to the investor. Beyond this, there are no quotable changes.

The chief movement amongst Manufacturing Companies' issues is a drop of 7 in Brush 4½ per cent. First Debenture stock, lowering the price to 42½. This drop is based on the offering of a small parcel, and it will be noticed that the yield on the stock now amounts to 10 per cent. on the money, while the company's Second Debenture returns over 14 per cent. It is scarcely necessary to say that this observation is not made with the idea of inducing staid investors to buy Brush Debenture of either class to put away with their gilt-edged securities. Henley's Ordinary are ¼ up, and Telegraph Constructions rose 10s.; while Aron Preference put on 3/16 upon notice being drawn to the manner in which these manufacturing companies are flourishing, and to the substantial percentage that the Aron shares yield to a buyer at the present figure. Rubber shares are dull, and the putting up of about 900 tons at the auctions this week in Mincing Lane had the effect of depressing to a slight extent the price of the commodity.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, February 12th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	per lb.	2⅜d.	..
a „ Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	„	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	„	£6 5	15s. inc.
a Bisulphide of Carbon	„	£18	..
a Borax	„	£17 10	£1 inc.
a Copper Sulphate	„	£23	£2 10 dec.
a Lead, Nitrate	„	£29 10	..
a „ White Sugar	„	£27 10	..
a „ Peroxide	„	£32	..
e Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3⅝d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a „ Chlorate	per lb.	3½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	„	7½d.	..
a Shellac	per cwt.	72/6	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70/72 %)	„	£10 5	..
a „ Chlorate	per lb.	3⅜d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£93	£2 dec.
b „ Wire, in ton lots	„	£112	..
b „ Sheet, in ton lots	„	£120	..
p Babbitt's metal ingots	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8⅜d.	1/32d. dec.
c „ Tube (brazed)	„	10⅜d.	⅛d. inc.
c „ „ (solid drawn)	„	9½d.	⅛d. inc.
c „ Wire, basis	„	8⅜d.	3/32d. dec.
c Copper Tubes (brazed)	„	11⅜d.	⅛d. dec.
c „ „ (solid drawn)	„	11½d.	3/32d. dec.
g „ Bars (best selected)	per ton	£83	£9 dec.
g „ Sheet	„	£83	£9 dec.
g „ Rod	„	£83	£9 dec.
d „ (Electrolytic) Bars	„	£76	..
d „ „ Sheets	„	£93	..
d „ „ Rods	„	£81	..
d „ „ H.C. Wire	per lb.	9¾d.	..
f Ebonite Rod	„	5/8	..
f „ Sheet	„	4/9	..
n German Silver Wire	„	1/10	..
h Gutta-percha, fine	„	7/- to 8/-	..
h India-rubber, Para fine	„	4/8	4½d. dec.
l Iron Pig (Cleveland warrants)	per ton	64/8	7d. dec.
l „ Wire, galv. No. 8, P.O. qual.	„	£14	..
g Lead, English Pig	„	£17 2 6	£1 5 dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£7 15	6/6 inc.
e Mica (in original cases) small	per lb.	6d. to 8s.	..
e „ „ „ medium	„	3/6 to 6/-	..
e „ „ „ large	„	7/6 to 11/-	..
o Nickel, sheet, wire, &c.	„	3/6 to 4/6 nom.	..
p Phosphor Bronze, plain castings	„	1/2 to 1/8½	½d. dec.
p „ „ rolled bars & rods	„	1/2	..
p „ „ rolled strip & sheet	„	1/2½	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	11½d.	..
Steel, Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£226 to £227	£5 10 dec.
n „ Wire, Nos. 1 to 16	per lb.	2/8½	½d. dec.
p White Anti-friction Metals	per ton	£45 to £228	£2 dec.
k Zinc, Sh't (Vieille Montagne bnd.)	„	£30	£1 12 6 dec.

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

W. T. Glover & Co., Ltd.—The directors (says the *Financier*) have declared a dividend for the year of 5 per cent. per annum on both the cumulative preference shares and the ordinary shares, and in addition a bonus of 2½ per cent. on the ordinary shares. They also recommend the allocation of £6,500 to the debenture redemption fund and the transfer of £5,000 to the reserve fund, carrying forward about £8,000. The first mortgage debenture redemption fund will then stand at £33,000, the second mortgage debenture redemption fund at £24,000, and the reserve fund at £20,000.

Continental.—France.—A new company has lately been formed in Paris (24, Boulevard des Capucines) with a capital of £48,000, and the title La Société des Ateliérs de Constructions Electriques de Delle.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Feb. 11th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	9⅞ — 10⅛	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8⅞ — 9⅛	..	4 19 4
Do. Second 6 % Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord.	5	10	9†	8⅞ — 9⅛	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8¾ — 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95 — 98	..	4 1 8
Charing Cross, West End & City	5	5	5†	4⅞ — 5⅛	..	4 17 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4⅝	..	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅛	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	4†	4⅜ — 5⅛	..	4 15 3
Do. 4½ % Deb.	Stock	4½	4½	96 — 99	..	4 10 11
City of London, Ord.	10	8	6†	17 — 18½	+ ½	4 8 6
Do. 6 % Cum. Pref.	10	6	6	12⅜ — 13⅛	..	4 9 0
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb.	100	4½	4½	100 —102	..	4 8 3
County of London, Ord.	10	6	4†	11⅛ — 12	..	5 0 0
Do. 6 % Pref.	10	6	6	11⅝ — 12⅛	..	4 19 9
Do. 4½ % Deb.	Stock	4½	4½	104 —106	..	4 4 11
Do. 4½ % Second Deb.	Stock	4½	4½	98 —101	..	4 8 3
Edmundson's, Ord.	£3	Nil	..	1/16 — 1/8	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4⅛ — 4⅜	..	..
Do. 6% Non-Cum. Pref.	5	..	..	1⅜ — 1⅝	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	82 — 85	..	5 5 11
Folkestone	5	6	6	4⅝ — 5⅛	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	8†	7⅞ — 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7⅝ — 8⅛	..	5 10 9
Do. 4 % Deb.	Stock	4	4	90 — 93 xd	..	4 6 0
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80 xd	..	5 12 6
London Electric, Ord.	3	2½	..	1½ — 2	..	3 15 0
Do. 6 % Pref.	5	6	6	5 — 5⅝	..	5 11 7
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	4	4†	3½ — 4	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4½	..	5 0 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	97 —100	..	4 10 0
Do. 3¾ % Mort. Deb.	Stock	3¾	3¾	84 — 86	..	4 1 5
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	98 — 101	..	4 9 1
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅞ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99½ — 102½	..	4 17 7
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅜ — 10⅜	..	5 11 7
Oxford	5	7½	6†	6½ — 6⅝	..	5 9 6
St. James' and Pall Mall, Ord.	5	10	10†	9½ — 9⅝	— ⅛	5 3 11
Do. 7 % Pref.	5	7	7	6⅝ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84 — 87	..	4 0 6
Smithfield Markets, Ord.	5	2	..	¾ — 1¼	..	..
South London, Ord.	4	5	..	2⅜ — 3⅛	..	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	97 —100	..	5 0 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1¼	..	5 12 0
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 11 8
Urban, Ord.	£3	Nil	..	⅛ — ¾	..	..
Do. 5 % Cum. Pref.	5	2	†	2⅝ — 3⅛	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	85 — 88	..	5 2 0
Westminster, Ord.	5	10	9†	8⅝ — 9⅛	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅝ — 5⅛	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 6 8
Calcutta, Ord.	5	8½	7†	6⅝ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	92 — 94	..	5 6 5
Canadian Gen. El. Com.	$100	7	7	116 —120	..	5 16 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 18 0
Cordoba Lt., Power and T., Ord.	1	3	5	13/16 — 15/16	..	5 6 8
Do. 5 % Deb.	100	5	5	96 — 99	..	5 1 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	93 — 95	..	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 1/8	..	Nil
Do. 6 % Pref.	1	6	6	⅜ — ½	..	9 15 2
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1⅜ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104	..	4 16 2
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	84½ — 86½	..	5 15 7
Mexican Lt. & Power, Common	$100	4	4†	80 — 84	—2	4 15 3
Do. 7 % Cum. Pref.	$100	7	7	105 —109	..	6 8 5
Do. 5 % 1st Mort. Gold Bds.	..	5	5	94½ — 96½	— ½	5 3 8
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	86 — 88	—1	5 13 8
Montreal, Lt., H. and Power	$100	8	9†	240 —245 xd	..	3 13 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	217 —227	..	4 8 0
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 —111	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	100 —102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	5	5	144 —148	—4	3 7 7
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 —108	..	4 12 7
Do. 4½ % Per. Deb.	Stock	4½	4½	100½ —102½	..	4 7 10
Toronto Power, 4½ % Deb.	Do.	4½	4½	98½ —100½	..	4 9 7
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	11½d.	17/8d.	32/32 — 34/32	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	105 —107	+1	5 12 2

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	7 — 7½	..	6 0 0
Do. 5 % Deb. Red.	Stock	5	5	97½ — 99½	..	5 0 6
American Telep. & Teleg., Cap.	$100	8	8†	134½ — 136½	..	5 17 3
Do. Collat. Trust	$1000	4	4	91 — 93	..	4 6 0
Anglo-American Telegraph	Stock	8	8	65½ — 67½	..	4 8 11
Do. 6 % Pref.	Do.	6	6	110a — 111½	..	5 7 7
Do. Def.	Do.	30/-	..	24⅜ — 24⅝	— 3/16	6 1 3
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7⅛ — 7⅜	..	5 3 3
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	78 — 80	—1	5 0 0
Cuba Telegraph	10	6	6†	8½ — 9½	..	6 9 9
Do. 10 % Pref.	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	8⅛ — 8⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅞ — 7	..	7 2 10
Direct United States Cable	10	5	4	6⅞ — 7⅛	..	6 15 7
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	132 —135	..	5 3 8
Do. 3½ % Pref. Stock	Do.	3½	3½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	..	4 1 8
Eastern Extension	10	7	7†	13 — 13⅜	..	5 3 8
Do. 4 % Deb.	Stock	4	4	95 — 97 xd	..	4 2 6
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 —101	..	3 19 3
Globe Telegraph and Trust	10	6	6†	10⅜ — 10⅞	..	5 10 4
Do. 6 % Pref.	10	6	6	12¾ — 13⅛	..	4 13 2
Great Northern Telegraph	10	18	18	22½ — 80½	..	5 18 0
Indo-European Telegraph	25	13	5†	57 — 59	..	5 10 2
Mackay Companies Common	$100	5	5	85 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	68 — 72	..	5 11 1
Marconi's Wireless Telegraph	1	20	..	4⅞ — 4 5/16	— 1/16	4 7 9
Do. 7 % Cum. Partic. Pref.	1	17	..	3⅞ — 4	..	4 5 0
Monte Video Telephone, Ord.	1	6	6†	1 3/16 — 1 1/16	..	5 13 0
Do. 5 % Pref.	1	5	5	⅞ — 7/8	..	5 14 3
National Telephone Def.	Stock	6	..	90 — 95	—4	..
New York Telep., 4½% Gen. Bnds.	100	4½	4½	98½ — 99½	..	4 10 8
Oriental Telep. and Elec.	1	8	6†	13⅜ — 13⅝	..	4 9 10
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 7/16	..	4 18 6
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97½ — 99½	..	4 0 5
Reuter's	10	10	10†	11⅜ — 11⅝	..	8 10 2
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	97 — 99	..	4 10 11
United River Plate Telephone	5	8	..	7⅞ — 7¾	..	5 4 1
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅜	..	4 8 11
West Coast of America	2½	2½	..	1 3/16 — 1 5/16	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	95 — 98	..	4 1 8
West India and Panama Teleg.	10	2½	1½†	3⅛ — 3 3/16	..	..
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10⅛	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7†	18⅜ — 18⅝	..	5 2 9
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	97½ —100½	..	4 10 0

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Feb. 11th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	⅜ — ⅝	..	Nil
Do. 5 % Pref.	1	5	5	1 1/16 — 1 1/8	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref.	100	..	..	10⅜ — 12½	..	..
Do. Do. Deferred	100	..	..	4½ — 6⅜	— ⅛	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	86½ — 89½	— ⅛	6 14 1
Do. 7 % Non-Cum. Pr'f.	100	..	..	86½ — 89⅜	— ⅛	..
Do. 5 % Perp. Deb.	100	5	5	91 — 95	..	5 5 3
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81	..	5 7 2
Central London Railway, Ord.	100	3	3†	81 — 83	..	3 12 3
Do. Pref.	100	4	4	84 — 86	..	4 13 0
Do. Def.	100	2	..	81 — 83	..	2 8 2
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
City & South London, Ord.	100	1½	1½†	37½ — 38½	..	3 11 5
Do. 5 % Pref., 1891	100	5	5	107 —109	—2	4 11 9
Do. Do. 1896	100	5	5	107 —109	—2	4 11 9
Do. Do. 1901	100	5	5	107 —109	—2	4 11 9
Do. Do. 1908	100	5	5	107 —109	—2	4 11 9
Do. 4 % Deb.	100	4	4	97 — 99	—1	4 0 10
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅛ — 2⅜	+ ⅛	Nil
Hastings Trams, 6 % Pref.	1	6	6†	15/16 — 1 1/16	..	7 7 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅜	..	4 15 3
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	78 — 80	..	6 5 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	4⅛ — 5⅛	— ⅛	..
Do. 4 % Deb.	100	4	4	69 — 72	..	5 11 1

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Feb. 11th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	* 100	1⅞	1⅞	58½ — 54 xd	+ ⅛	3 0 2
Do. Surplus Lands	100	2⅛	2⅛†	61 — 63 xd	..	4 6 0
Do. 5½ % Deb.	100	5½	5½	86 — 88	..	3 17 9
Do. 5½ % Pref.	100	5½	5½	83 — 85 xd	—1	4 2 4
Do. 5½ % Con. Pref.	100	5½	5½	83 — 85 xd	..	4 2 4
Metropolitan District Ord.	100	Nil	Nil	40⅛ — 41	— ⅛	Nil
Do. 6 % Deb.	100	6	6	139 —141	..	4 4 0
Do. 4 % Deb.	100	4	4	93 — 95	..	4 2 6
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 8
Do. 4½ % First Pref.	100	4½	4½	89 — 91	..	4 18 11
Do. 5½ % Gtd.	100	5½	5½	75 — 77 xd	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	6	5†	1 3/32 — 1 1/16	— ⅛	5 16 4
Do. 5 % Pref.	1	5	5	1 — 1 1/16	..	5 14 3
Do. 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 10
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Potteries, Ord.	1	5/16	..	1/16 — 1/16	..	..
Do. 5 % Pref.	1	5	5	1/8 — 1/4	..	6 13 4
Do. 4½ % Deb.	100	4½	4½	86 — 88	..	5 2 3
South Metro. Trams, 6 % Pref.	1	6	..	1/16 — 1/8	..	7 7 8
Do. 4 % Deb.	100	4	4	65 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	4½ — 4⅝	— 1/16	Nil
Do. "A"	1/-	..	..	1/16 — 1/8	+ 1/32	..
Do. 6% First Cum. Inc. Deb.	100	..	6	111½ —113½	..	5 5 9
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10 0
Do. 6 % Income	100	1½	6 †	95 — 96	..	..
Yorkshire (West Riding), Ord.	5	Nil	..	1/16 — 1/8	..	Nil
Do. 6 % Pref.	5	3	3†	2⅞ — 3⅛	..	4 12 4
Do. 4½ % Deb.	100	4½	4½	80 — 84	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅞ — 5⅛	..	5 7 4
Do. 2nd Pref.	5	5½	5½	4 15/16 — 4 13/16	..	5 14 3
Do. 4 % Deb.	100	4	4	93½ — 95½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	98½ —100½	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	101 —103	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	99 —101	—2½	..
Brisbane Trams Invt., Ord.	5	8	8†	7 — 7⅛	+ ⅛	5 6 8
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 15 8
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	..	140 —144	—1	5 11 1
Do. Pref. Ord.	100	6	6	120 —124 xd	..	4 16 9
Do. 5 % Pref.	100	5	5	106 —109	+1	4 11 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 —103	..	4 7 5
Do. 4½ % Con. Deb.	100	4½	4½	97 —100	..	4 5 0
Calcutta Trams, Ord.	5	7	5†	6⅜ — 6½	..	5 12 0
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
Cape Electric Trams	1	2½	..	3/8 — 7/16	..	..
City Buenos Aires Trams (1904)	5	5	5†	5⅛ — 5⅜	+ 1/16	4 6 11
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 2 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	7/16 — 9/16	..	Nil
Do. 5 % A Deb.	100	5	5	88 — 88	..	5 13 8
Do. 6 % B Deb.	100	6	3	80 — 40	..	..

La Plata Elec. Trms, Ord.	1	Nil	..	7/16 — 9/16	..	..
Do. Pref.	1	6	..	15/16 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1 — 1⅛	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 95	..	5 5 8
Madras Elec. Tr. (1904), Deb.	100	5	5	101 —103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 90	..	5 11 1
Manila Elec. R. and Lig., Bonds	$1000	5	5	100½ —102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	109 —112	—1½	6 5 0
Do. Gen. Con. 5 % Bonds	..	5	5	95 — 97	—1½	5 3 1
Do. 6 % Bonds	100	6	6	100 —102	— ½	5 17 8
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7½ — 8	..	6 5 0
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	98½ —100½	+ ½	4 19 6
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1 3/16 — 1 1/4	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	105 —108	..	4 12 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅞	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	102 —103	..	4 17 1
Do. 5 % Mort. Bonds	100	5	5	96 — 98	— ½	5 2 0
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	104 —106	+ ½	4 14 4
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	97 —99 xd	..	5 1 0
Un. Elec. Trams Monte Video	5	7	6†	5⅛ — 5⅜	..	6 1 9
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	3/4 — 7/8	..	8 0 0
Do. 6 % Pref.	1	6	6	31/32 — 1	+ 1/32	7 2 2
Babcock & Wilcox	1	28	14†	8 3/8 — 8 5/8	..	3 18 8
Do. Pref.	1	6	6	1 3/16 — 1 1/4	..	4 0 0
British Aluminium, Ord.	1	Nil	..	1/2 — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	..	1/2 — 1	..	..
Do. 5 % Prior Lien Debs.	100	5	5	91 — 94	..	5 6 5
Do. Deb. Stk.	100	5	5	87 — 90	+1	5 11 1
B.I. & Helsby Cables	5	10	8†	8 — 8¼	..	5 17 8
Do. Pref.	5	6	6	5⅞ — 6¼ xd	..	4 16 0
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	96½ — 98½	+ ½	4 11 5
British Westinghouse, Pref.	8	Nil	Nil	3/4 — 7/8	..	Nil
Do. Deb.	100	4	4	58 — 61	..	5 11 2
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	3/4 — 7/8	..	Nil
Do. Pref.	1	..	..	4/6 — 5/-	..	Nil
Brush, 7 % Pref.	8	Nil	Nil	0 — 1/4	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	73 — 78	..	6 8 2
Do. 4½ % Deb.	100	4½	4½	40 — 45	—7	10 0 0
Do. 4½ % Second Deb.	100	4½	4½	28 — 32	..	14 1 4
Callender's Cable	5	15	10†	11 — 11⅜	..	6 7 8
Do. Pref.	5	5	5	4⅞ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	20	3 1/16 — 3 1/8	..	5 5 0
Do. Deb.	100	4½	4½	103 —106 xd	—2	4 4 11

Crompton & Co.	3	Nil	..	1/4 — 3/8	..	Nil
Do. Deb.	100	5	5	55 — 57	..	9 15 6
Dick, Kerr	1	5	Nil	1/16 — 1/8	..	..
Do. Pref.	1	6	6	1/16 — 1/8	..	6 17 2
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid	5	Nil	..	0 — 1/4	..	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	61 — 65	..	6 3 1
Do. 5 % Second Deb.	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	2½	1 3/16 — 1 1/8	..	5 14 4
Do. Pref.	2	7	7	2 — 2 xd	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7⅛ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	9⅜ — 10⅜	..	..
Do. Deb.	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	13 — 13⅜	+ ⅛	6 3 8
Do. Pref.	5	4½	4½	4⅝ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	..	7½	10 — 11	..	6 16 4
Do. Pref.	10	5	5	9½ — 10½	..	4 17 7
Telegraph Construction	12	17½	5†	85 — 87	+ ½	5 13 6
Do. Deb.	100	4	4	95⅛ — 96⅜	..	4 1 3
Willans & Robinson	1	Nil	..	1/16 — 1/8	..	Nil
Do. Pref.	5	Nil	..	1/4 — 3/8	..	Nil
Do. Deb.	100	4	4	57 — 59	..	6 15 7

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

THE LOWEST TENDER.

The usual system, almost invariably adopted, of placing contracts with the lowest tenderer, though doubtless the simplest, is often not the best either for the customer or the contractor. A small but recent example of its defects is characteristic. A small country-house job, comprising a 5-B.H.P. oil engine of specified make, dynamo, 350-a.h. battery, switchboard, main cable, and wiring in screwed conduit for some 120 lights, was tendered for by four firms. Three were firms of repute, specialising in country-house work; and their tenders were respectively £453, £422 and £397—keen competitive prices. The fourth tender was sent in by a local firm of "electrical contractors," and their price was £280. And they went one better than the specification by offering a larger battery and a direct-coupled instead of a belt-driven set.

It is obvious that the successful tenderers—needless to say, the local firm got the contract—have either made a big mistake which will result in a serious loss, or it is their deliberate intention to scamp their work and hoodwink the consultant—not a difficult thing to do, as a rule. Such is the case too often, when contracts are placed with the lowest tenderer, who finds himself faced with the alternative of a loss on the job or a profit at the expense of his employers' interests.

A better system is not inconceivable. Each tender submitted is necessarily nothing more than the tenderer's approximation to the true cost, plus a definite profit. It is a mathematical axiom that the average of a number of approximations will tend to be more correct than any individual approximation. Obviously, then, if, instead of placing a contract with the lowest tenderer—who, as often as not, is the lowest tenderer because he has made a mistake—it were given to the tenderer whose price was closest to the average of all the prices submitted, the chances are it would be secured by the tenderer whose price was the fairest for the work required. He would thus gain a reasonable profit, and would have no incentive to save money on the quality of his work at the expense of the employer. At the same time, prices would be no less competitive than at present, as clearly the man who quoted an inflated price would stand as little chance of success as he who quoted too low a figure. Indeed, prices would tend to become more reasonable in all cases. The "cutter" would not cut, because he would know it would be useless, and the man who now submits a high price rather than risk getting the job at an unprofitable figure, would be inclined to quote lower than he would otherwise, knowing that, if he got the job at all, it would be at a fair figure.

In the example given above, the sum of the four tenders is £1,552, which, divided by the number of tenderers, gives an average of £388. The successful tenderer, had the method outlined herein been adopted, would have been he who quoted £397, which, on the face of it, is a fair price—albeit not a "fat" one—and one which would enable him to give the employer better value for his money than he is likely to get from the lowest tenderer.

To take another instance: an asylum wiring job recently advertised for public tender. The results were published in the technical papers. Thirty-two firms competed, comprising some of the best known London firms, with others of less repute. Prices ranged from £2,304 to £987, and the contract was given to a firm whose price was £993.

The average of these tenders is £1,398, and the nearest tender to this figure was one of £1,400. Twenty-two out of the 32 tenders were within 20 per cent. of the average. The architect's estimate was £1,270. The highest tender was nearly £1,000 more than the average, and the lowest more than £500 less.

Clearly it is unreasonable to suppose that the figure which secured the order was the correct one, and that the 22 firms who quoted figures approximating to the average—£500 higher—were all wrong. It is more probable that the lower tenders represent mistakes as great in one direction as those made by the tenderers who submitted prices of £2,000 and more. Consequently it is more than likely the successful contractor has found himself faced with the usual deplorable alternative, of either suffering himself, or making the employer suffer.

It is too much to hope that such an equitable system of choosing tenders as that herein outlined will be adopted by public bodies, who are notoriously conscienceless. It would be something if they could be induced to rule out those tenders which are so much less than the average as to show they are based on either a mistake or a deliberate intention to evade the specification. As it is, contracts are too often placed on obviously erroneous prices, the soulless public body caring nought for the loss which the contractor must inevitably suffer if their engineer, on whom they rely to see that the specification is properly carried out, is successful in enforcing it. Which he very rarely is.—H. R. T.

AN APPARATUS FOR SIGNALLING THUNDERSTORMS.

[BY OUR BERLIN CORRESPONDENT.]

The first attempt to investigate atmospheric discharges by a method related to radio-telegraphy—viz., by means of a Branly tube or coherer—was made as far back as 1895-6 by the Russian physicist, Prof. Popoff. An insulated aerial wire directly connected to one pole of the coherer was used in this connection, the other pole (in accordance with a practice later adopted by Marconi) being joined to the ground. Prof. Popoff thus was able to ascertain that atmospheric discharges, on account of their oscillatory character, would excite the coherer, thus enabling thunderstorms to be recorded by means of a Morse apparatus or bell signal.

On the same principle is based the storm indicator designed by the Telefunken Co., but the arrangement of connections differs considerably from the original plan.

As seen from fig. 2, a spark gap F and a coil S connected up to the earth conductor E are inserted into the aerial wire L. The coherer Fr and a blocking condenser C are arranged in parallel with the coil, the relay circuit, which comprises the cell and the relay coils Sr, being branched off, as usual, from the condenser. The secondary circuit

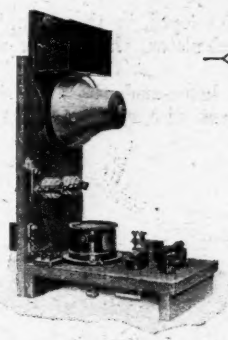


Fig. 1.

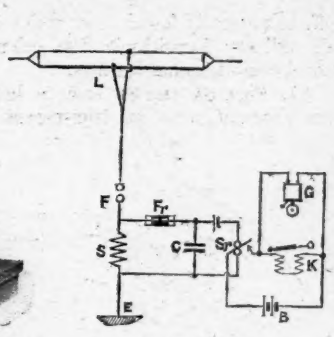


Fig. 2.

of the relay contains a battery B, which, on the relay contact being completed, actuates a tapper K and a recording apparatus (in the present case a single-stroke bell G).

The spark gap having been adjusted to a spark distance of a few tenths of a millimetre, a series of sparks will pass, thus exciting the coherer and sounding the bell as soon as there are any charging phenomena in the atmosphere. Feeble atmospheric accumulations, that is to say, far distant thunderstorms, will result in a slow charging of the aerial wire, and accordingly in the passage of sparks at considerable intervals. Since the signal bell is sounded in the very rhythm of spark discharges, the sequence of sound allows the distance of the thunderstorm from the recording apparatus to be gauged. In the place of the single-stroke bell, a Morse recorder with self-disengaging paper tape can be connected up to the apparatus, thus marking each passage of a spark by a point on the tape. If the speed at which the paper is unwound be known, the distance of the thunderstorm can be gauged by measuring up the paper tape and counting the number of points recorded thereon.

GRAPHS IN A CABLE-SHIP DRUM-ROOM: NOTES FOR JUNIOR ASSISTANTS.

By EDWARD RAYMOND-BARKER.

(*Concluded from page* 240.)

86. When the writer contrived a device which, by means of the relative movements of two co-adjacent logarithmic scale lines, would indicate cable slack percentages straight

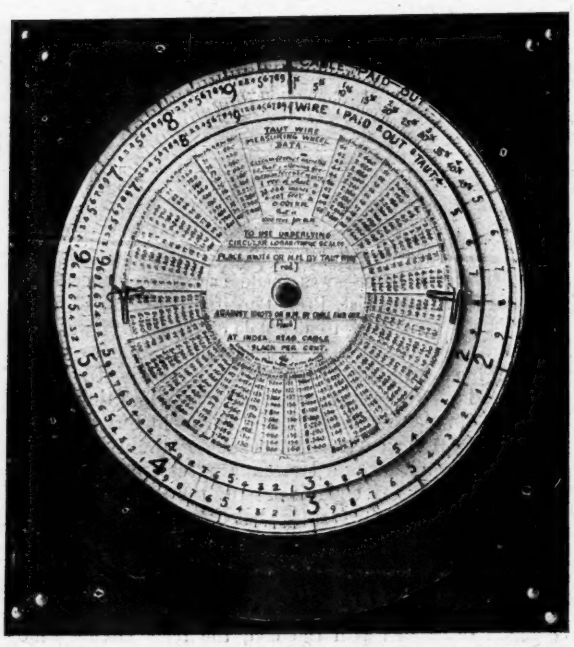


Fig. 8A.

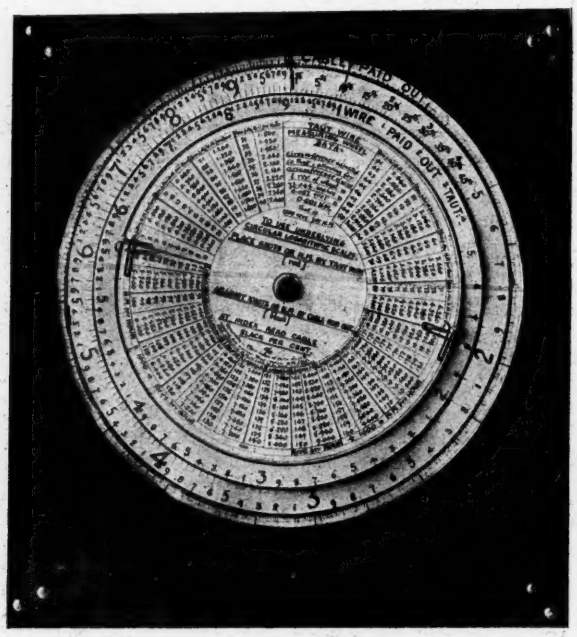


Fig. 8B.

off, he naturally found that it developed, in the main, into an ordinary logarithmic disc calculator, though one with novel constructional features.

87. Figs. 8A and 8B show a home-made hand-inscribed experimental form of transparent disc calculator (13 in. diameter); 8A shows the upper and transparent disc, with its index set *to unity*; 8B shows index set to 10 per cent. The spare space between the working parts and the disc centre is utilised for—*inter alia*—a useful table at once recognised as relating to matter dealt with in 49, viz., taut-wire measuring-wheel *revs. per min.*, and equivalents in N.M. *per hour*.

88. An over-lying movable logarithmically-scaled disc of transparent celluloid, with all graduations and figures inscribed in bright *red*, moves concentrically over a lower cardboard disc similarly graduated and figured in *black*.

89. Thus, the *black* figures and scale lines on the lower disc are seen through the upper and transparent disc, which is inscribed with *red* figures and scale lines. This facilitates quick coincidence of any scale-division on the upper disc with any on the under-lying disc, the upper-disc *red* figures contrasting sharply with the lower-disc *black* ones.

90. Also, the relation of one set of scale divisions to the other can be observed, not only between the outer and inner divided scales, as is ordinarily done, but—owing to the transparency of the upper disc—right *through* the upper set

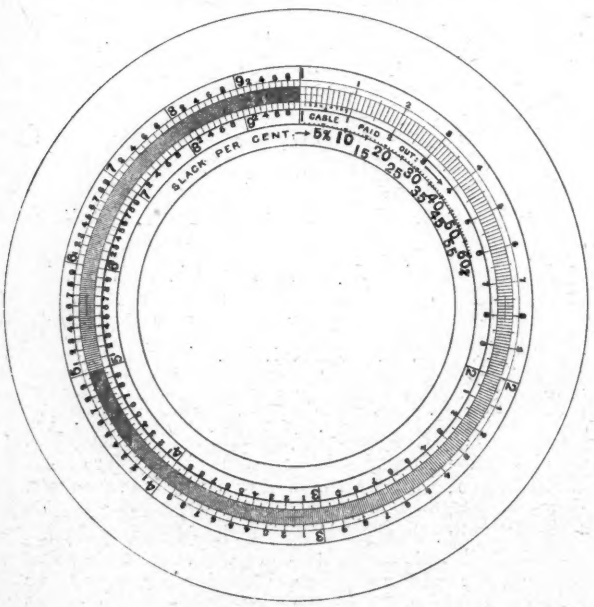


Fig. 9A

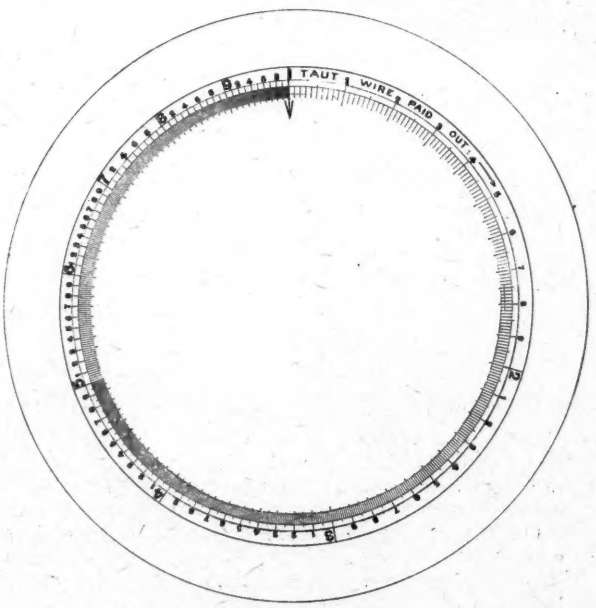


Fig. 9B.

of red figures and scale divisions, to the black scale-lines of the under-lying cardboard disc on which the upper disc is superimposed. In this case, therefore, comparison is made between circular logarithmic scales of equal circumference, instead of between an outer circle and a smaller inner circle.

91. The *black* figures on the lower disc represent *cable* values; the *red* on the upper transparent disc, the *taut-wire*.

Example.—(See fig. 8B.)

By turning the upper disc on its centre, let, say, 7·6 (*taut-wire* knots) be set to 8·36 (*cable* knots). The red index on the upper transparent disc will then point to 10 per cent. cable-slack, shown in black figures on the underlying cardboard disc.

92. Conversely, granted the necessity for, say, 10 per cent. cable slack over any particular distance, on the index

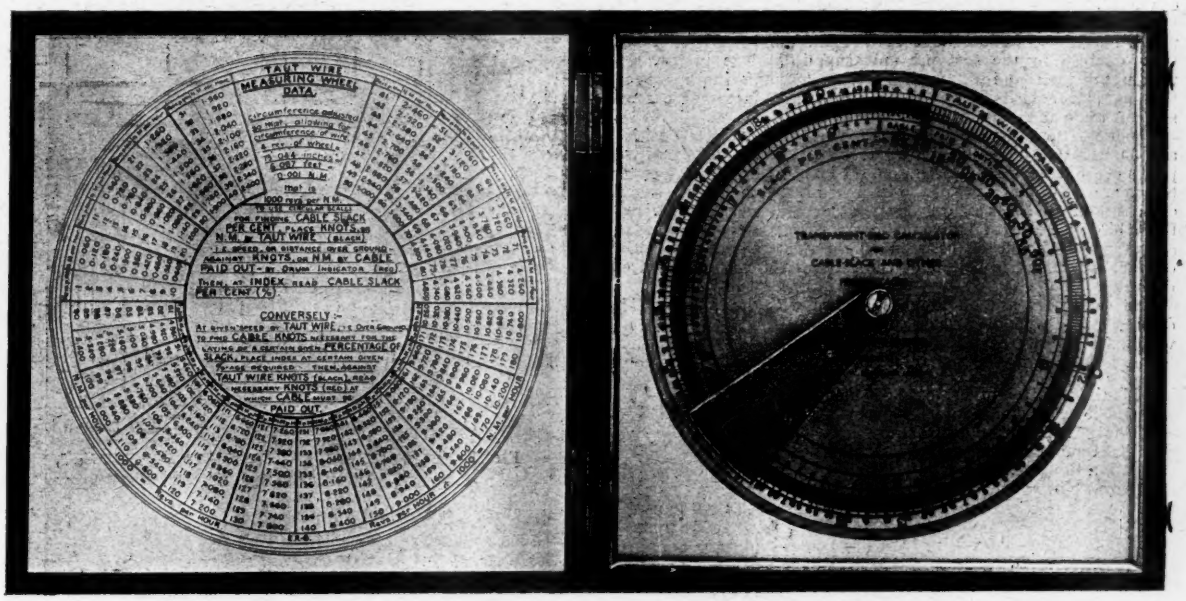


Fig. 10.

being set at 10 per cent., all relative *taut-wire* and *cable* speed-rates—for 10 per cent. slack—will be found set severally to each other. For instance—

8·5	knots	*taut-wire*	is set to	9·35	*cable*.
7·6	,,	,,	,,	8·36	,,
5·5	,,	,,	,,	6·05	,,

93. The transparent-disc calculators here illustrated are not seen to advantage, as the prints, of course, do not show the striking contrast between the *black* and the *red* scales and figures.

94. A transparent-disc calculator may be made with inner and outer circular spaces respectively for *taut-wire*-wheel revs. per min. and *cable*-drum revs. per min. These equivalents would be in line with their several scale-divisions, as in the calculator board, fig. 7. The said circular spaces would be of white matt-surface celluloid, so that temporarily required *revs. per min.* could be pencilled in, to be erased, when done with, at the end of an expedition.

95. Or, if graph methods be preferred throughout, a disc calculator for, say, all *three* drums on a given ship, may have the *revs. per min.* equivalents permanently recorded; radiating in line with the corresponding scale-divisions. In that case, the correction percentages for various cable circumferences would be obtained from the curve in fig. 4, applied by slide-rule, and addition to the drum-revs. per min. values. (See 38, 48 and 83.)

96. Figs. 9A, 9B and 10 severally show the detail and the general appearance of a transparent-disc calculator of more or less standardised form. The relative positions of the *black* and the *red* series of scale-lines and figures are the reverse of those in figs. 8A and 8B; this circumstance being due to the great difficulty experienced in printing *red* on celluloid.

97. Figs. 9A and 9B show respectively the lower (opaque) and the upper (transparent) working discs.

98. Fig. 10 shows the entire transparent disc calculator mounted in a wooden case, opened out on hinges, to expose the calculator and some tabulated figures already referred to. (See 87.)

99. Experience goes to show that a very reliable calculator of this kind could be made with its upper disc of glass. The engraved lines would be on the lower surface, so as to be in close contact with the underlying opaque disc, to the avoidance of parallax. Unfortunately, glass work of this kind is very costly.

100. There remains celluloid. This material, however, under the heat attending the process of printing is not free from molecular changes conducive to a greater or less degree of warping; so success in this direction has not exactly reached finality.

101. Enough has been written to show some points of interest pertaining to graphs, &c., in the drum room. The writer hopes, at some not long-distant date, still further to develop this subject in fresh directions.

Aluminium in European Electrical Undertakings.—According to a report by M. E. D'Hoop, Director of the Technical Service of the Brussels Tramways Co., presented to the Christiania Congress (1912) of the Union de Tramways et de Chemins de Fer d'Intérêt Local, the use of aluminium cables in Europe is developing; eight undertakings have them in use, namely, Copenhagen Municipal Tramways, Geneva Tramways Co., Lausanne Tramways, Lyons Tramways and Omnibus Co., Nuremberg Municipal Tramways, Nogentais (Paris) Co., the Paris General Omnibus Co., and the Société Nationale des Chemins de Fer Vicinaux, of Belgium. Some of the cables used for low pressure exceed 1,000 sq. mm., the maximum mentioned reaching 1,700 sq. mm. section. The Siemens-Schuckert firm report the installation of a cable with a single aluminium conductor for single-phase current at 60,000 volts, on the Muldenstein-Bitterfeld section of the Prussian State Railways. All who have adopted these cables state that they are satisfied with them, and no practical drawbacks have been experienced; the making of the joints and connections, however, necessitates the exercise of special care. There is an advantage in using aluminium for cables of large section for continuous current; in some instances the economy thus secured exceeds 14 per cent. According to a formula worked out by the Copenhagen tramways, the use of aluminium is advantageous when the price of aluminium in £ per ton is lower than 2·08 × price of copper − 30. This formula evidently assumes equality of the price of the other materials used in the manufacture of cables. Independently of the question of price, aluminium cables have the advantage, in the case of very high pressures, when it is necessary to augment the section of the conductors in order to increase the dielectric rigidity.

PROCEEDINGS OF INSTITUTIONS.

The Use of a Large Lighting Battery in Connection with Central Station Supply.

By F. H. WHYSALL, A.M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS *at Manchester, January 28th, and London, January 23rd,* 1913.)

THIS paper is, for the most part, based on the results obtained over two complete years' working of the 12,000 ampere-hour battery installed at the Manchester Corporation Electricity Works, Dickinson Street, in March, 1910. This battery was at the time of its installation the largest ever constructed, and has a maximum discharge capacity of over 15,000 amperes.

Before so large a battery could be recommended, the saving to be effected by its use had to be most thoroughly and carefully examined.

The object of the present paper is to show to what extent the predictions as to its use have been fulfilled, and what relief has been obtained in the cost per unit supplied. The battery has thoroughly justified itself during this period, and the figures in this paper should tend to encourage other engineers of central stations to go and do likewise.

The battery consists of 210 cells, each cell containing 38 positive and 39 negative plates 20¾ in. wide × 29 in. deep. The positive plates are of the Planté formation, 0·4 in. thick, cast in one piece, but the negative plates are of the improved box type, 0·31 in. thick, composed of half grids securely riveted together, the spaces between them being filled with active material. Specially treated wooden separators are employed between adjacent plates, and a free space of 8 in. is left at the bottom of the cell for the accumulation of deposit.

The cell boxes are of pitch pine lined with lead, the outside dimensions of each box being as follows:—Length, 6 ft. 1½ in.; width, 2 ft. 2½ in.; height, 3 ft. 4½ in.

The following are the guaranteed performances of the cells:—

Maximum discharge rate, 15,000 amperes.
One-hour discharge rate, 8,400 amperes (3,000 KW.).
Charging rate, 4,100 amperes.
Maximum charging rate, 6,500 amperes.
" " voltage, 2·75 volts per cell.
Ampere-hour efficiency, 90 per cent.
Watt-hour efficiency, 66 per cent. at 1-hour rate (8,400 amperes).
" " 75 per cent. at 3-hour rate (3,900 amperes).
Final voltage per cell, 1·67 volts at 1-hour rate.
" " 1·78 volts at 3-hour rate.
Weight of each cell and acid complete, 2 tons 19 cwt.
" complete battery, 620 tons.
Floor space occupied, 5,966 sq. ft.

The chief advantage attached to the use of regulating cells is that the output of the battery is not limited by the capacity of the boosting plant; and in cases where a battery is used as stand-by, regulating cells have distinct advantages over boosters. On the other hand, with large batteries the switchgear for regulating cells becomes, with its connections, a very cumbersome piece of apparatus.

The chief duty of the Dickinson Street battery is to take 3,000 KW. off the lighting peak. It is also looked upon as a stand-by. But its chief duty is load-levelling; and it was, therefore, decided to have three hand-regulated reversible boosters, and to run them in parallel at times of maximum discharge. At other times, one or two would be used as required. It may be noted, however, that such importance is attached to the question of overload in emergency, that it is the universal custom on the Continent to use regulating cells in all central-station batteries.

Short-circuiting switches are provided for all booster bus-bars, these switches being used to cut out the boosters under breakdown conditions, or when boosters are not required—for instance, on Sundays, when the battery does the whole of the lighting load for the greater portion of the day. The lighting load is much bigger than the traction load, and for some time it has been found more economical for that reason to confine the use of the battery to the lighting load.

The boosters are of the Turnbull-McLeod automatic reversible type, and were manufactured by the Lancashire Dynamo and Motor Co. They have equalising rings to every turn of the armature windings, on account of the heavy circulating currents, and the yokes of the boosters are laminated. Each booster is capable of a maximum boost of 5,600 amperes at 80 volts for a few minutes.

A diagram of connections is shown in fig. 1.

Two substantial circuit-breakers are inserted in the main cables as close as possible to the battery house. These circuit-breakers are of the magnetic blow-out type, and are capable of carrying 15,000 amperes continuously. Each is enclosed in a separate concrete cubicle, so as to entirely shield it from all other parts of station, and each is electrically and independently operated from the switchboard by means of solenoids. The circuit-breakers are non-automatic, and are provided with a suitable controller to show by means of signal lamps on the operating panels whether the circuit-breaker is closed or open. The large circuit-breakers on the main switchboard are of a similar type, but mechanically operated from the front of the panels. The circuit-breakers themselves, however, are also enclosed in concrete cubicles. The switchboard circuit-breakers are automatic.

Bus-bars of aluminium have been employed throughout.

In a typical winter-load curve at the time of the installation of the Dickinson Street battery, the load-factor works out at 32 per cent., and was expected to be improved to 43·5 per cent. In figs. 2 and 3 we have typical summer and winter-load curves since the installation of the battery; it will be noted that the load factors obtained are actually much greater than those anticipated, and are respectively 67·5 per cent. and 49·1 per cent.

In fig. 4 a chart is given showing the effect of load factor on coal consumption and works costs at Dickinson Street and Bloom Street works.

Dickinson Street is now considered an old station, and the largest units in Dickinson Street and Bloom Street stations are of not more than 1,800-KW. capacity. The observed coal consumption per unit—of the combined stations—has been down to the low figure shown on the chart. The lowest figure for a monthly observation per unit generated since the installation of the battery is 2·66 lb., and per unit sent out 2·79 lb., the difference being accounted for by units used at the works and units lost in the battery. The commercial efficiency of the battery was for the first year 70·6 per cent., and for the second year 71·1 per cent.

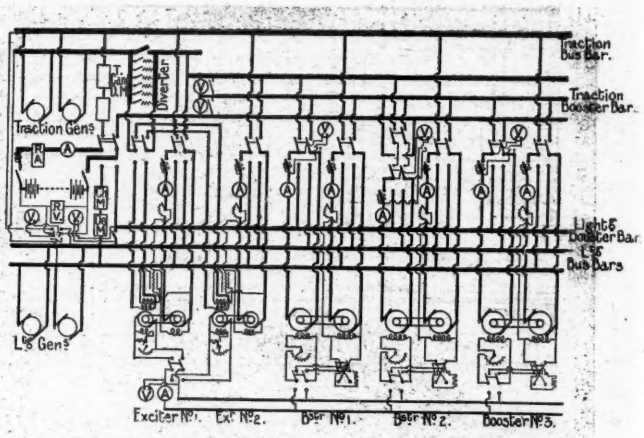


FIG. 1.—DIAGRAM OF BATTERY BOARD CONNECTIONS, DICKINSON STREET.

It is quite unfair to consider a battery capable of saving only the standby represented by its one-hour rating capacity. In a storm-load the maximum demand (ignoring traction) was 44·5 per cent. greater than the boiler capacity at the commencement of the darkness; and the battery was able to take care of the rising load ahead of the extra boilers which had to be got into commission. Without the battery it would have been impossible to get these extra boilers up in time, and would have meant practically a total failure of supply unless some portion of the load could have been cut off.

The actual costs came out as follows:—

3,000-KW. BATTERY AT 1-HOUR RATE OF DISCHARGE, INCLUDING BOOSTERS AND SWITCHGEAR.

Storage battery	£15,034	7 years.	Loan period.
3-motor booster combination	2,776	15 "	"
Switchgear	1,757	15 "	"
Buildings	2,000	20 "	"
Total ...	£21,567		

Estimated expenditure required to provide equivalent steam plant	£51,000
Actual cost of battery plant	21,567
Difference in capital expenditure	£29,433
Steam plant: £51,000 to be repaid in, say, 20 years:—	
(Interest, 3½ per cent., sinking fund, 3¾ per cent.)	£3,698
Battery plant: £21,567 to be repaid in 10 years:—	
(Interest, 3½ per cent., sinking fund, 8¾ per cent.)	£2,642
Saving in capital charges per annum in favour of battery	£1,056

COMPARISON OF COST PER KILOWATT OF CAPACITY.

	Estimated.	*Actual.*
Generating plant	£17 0 0	£16 16 6
Battery	6 13 4	7 3 9

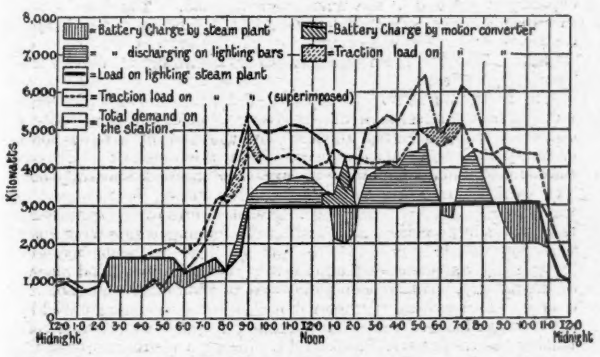
In these days of turbo-driven units, the capital cost might be taken at a lower figure.

Costs compiled from the latest actual figures available are estimated by the author as follows:—

	Total cost per KW.
Land	£0 5 6
All buildings (including offices)	3 13 0
Land for railway, railway complete and locomotive ...	1 9 0
Coal and ash plant	0 4 0
Marine boilers with superheaters, including economisers, coal and ash chutes, scraper and stoker driving ...	2 13 0
Foundations and flues for marine boilers	0 9 0
High-pressure steel pipes and covering, including valves (main range not included)	0 2 6
Turbo-alternator and condensing plant, pipework for condensing plant and motor-driven fans	3 5 6
Foundations for turbo-alternator and air ducts	0 4 0
Pipework for turbo-alternator, including circulating water pipes, atmospheric exhaust pipes and valves ...	0 5 0
Natural-draught cooling towers	0 13 0
Foundations for cooling towers	0 5 0
High-tension cable	1 8 0
Converting plant, including switchgear	2 0 0
Total	£16 16 6
Total plant installed ... ... 56,500 KW.	

Mr. Snell's figure of £12·26 per KW., given in his book on "Power House Design," does not include items in the author's estimate, amounting to £5 4s., which would bring up the cost per KW. on his estimate to £17·46.

It would seem, therefore, that, for peak-load duty of two hours (which averages out at the 1-hour rate of discharge for the battery)



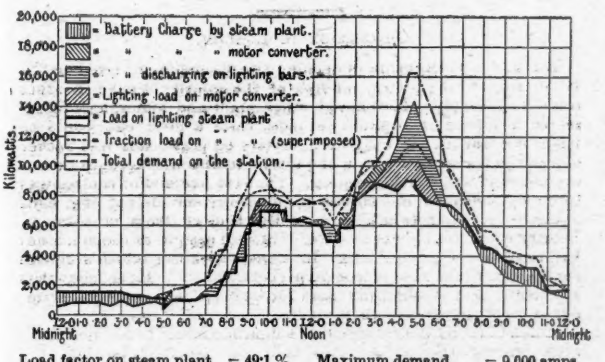
Load factor on steam plant = 67·5 %
" on max. demand = 54·4 %
Improvement in load factor = 13·1 %

Number of units generated = 88,500
Max. load on steam plant = 5,150 KW.
Max. demand on station = 6,400 KW.

FIG. 2.—SUMMER LOAD CURVE.

the cost per kilowatt can be safely estimated at £17, which leaves a margin of £9 16s. 3d. in favour of the battery.

It is necessary when considering the cost of generation of peak-load units to take into consideration the fact that the most uneconomical units are reserved for this duty, and quite rightly so, also



Load factor on steam plant = 49·1 %
" on max. demand = 84·4 %
Improvement in load factor = 14·7 %

Maximum demand = 9,000 amps.
Number of units generated = 134,080
Max. load on steam plant = 11,375 KW.
Max. demand on station = 16,250 KW.

Peak discharge = 11,000 ampere-hours.

FIG. 3.—WINTER LOAD CURVE.

that these peak-load sets will not be run at their most economical load; consequently, the steam consumption will be high. Bare fuel cost per 1,000 KW. standby for this peak-load duty the author has estimated at £1 8s. per day. But we have seen that it is unfair to credit the battery with standby savings on its bare capacity only. Our 3,000-KW. battery gave a yearly standby saving of £1,554.

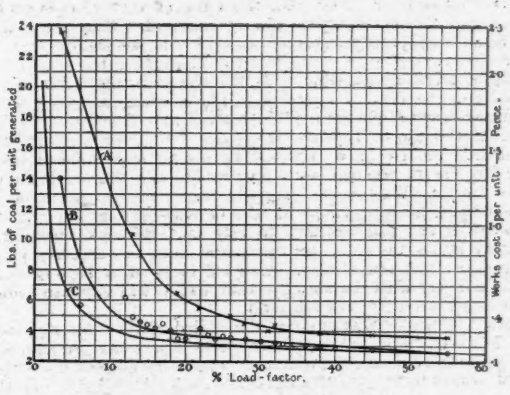
There is an actual saving on running fixed charges on the station when a battery is put in; at Dickinson Street there are now 22 fewer men for an increased demand since the installation of the battery. Comparing bare fuel cost per unit generated, and crediting the battery with a commercial efficiency of 70 per cent., we get a cost per unit (reckoning 2·5 lb. of coal per unit at 12s. 5d. per ton) of 0·237d. against a cost of 1·55d. taken from the actual results shown on the load-factor curve for 8 per cent. load factor. The peak-load units discharged by the battery since its installation, calculated at the rate of five complete discharges per week—March 31st, 1910, to March 31st, 1912—are 1,560,000, and represent an annual saving of £8,534. This takes no account of the morning discharges and load-levelling duty during the rest of the day, commonly called "buffering," whereby each set on load is kept running at its most economical output.

The improvement in load factor on the units generated, observed monthly over two years, is approximately 7½ per cent., and the value obtained from the chart is 0·08d. on 30½ million units; this represents a saving of £10,166. This is the actual improvement due to the battery, and should cover both the other estimates and include the saving due to the buffering effect as well.

Year.	Output to feeders.	Coal used.	Average price of coal.	Increase in coal cost, 1910 and 1911.	Total cost per unit output to feeders.	Saving in 1910-11 against 1909.	Total value of saving effected by battery with coal at 10s. 11d.	Commercial efficiency.
1909.	KW.-hours.	Tons.	s. d.	£		£	£	%
No battery..	25,818,992	40,681	10 11	—	0·368	—	—	—
1910.								
With battery	29,042,985	39,418	11 0	164	0·305	7,620	7,784	70·6

NOTE.—Calorific value varies between 13,500 and 14,000 B.TH.U.'s per lb.

In the table the actual saving on works costs for one complete year's working is given. The makers signed a contract to maintain the battery at its rated capacity for a term of 15 years



Curve A.—Works cost per unit generated in pence.
Curve B.—Pounds of coal per unit generated (from actual observations).
Curve C.—Pounds of coal per unit generated (by formula).

FIG. 4.—EFFECT OF LOAD FACTOR ON COAL CONSUMPTION AND WORKS COSTS.

for the sum of £1,250 per annum, which is 8·3 per cent. per annum on the purchase price. This maintenance is included in the works costs.

A recording ammeter and voltmeter are essential in order to see that overcharging or overdischarging does not take place. Charging is continued under normal conditions at Dickinson Street 10 minutes after gassing point is reached, before both daily discharges, and for 2 hours once each week, generally on Saturday, and preceding the day (Sunday) when a complete discharge at the 10-hour rating is usually taken out of the battery.

The efficiency of the battery for the day is units output ÷ units input, including booster units, which we term the "commercial efficiency."

The daily load curves are considered the most important records taken, because the value of a battery depends more on the way it is used than on anything else. A special battery book is kept, giving details of cell defects and their treatment (for which a 1,000-ampere portable "milking" booster is used), daily gassing, weekly overcharge, and all specific gravities and voltages of individual cells once each week after the weekly overcharge. Three pilot cells are used to serve as a guide to the state of charge, and the specific gravities of these cells are taken every half-hour for the station log sheet, which is the general record of the working of the station usually found in use at most central stations.

The capacity of the battery varies at various rates of discharge, and without these pilot-cell readings it would be exceedingly difficult at times to gauge the exact state of the battery.

It is now being recognised that, provided the battery is installed to reduce generating plant, it is a sound commercial proposition when considered in connection with a large lighting load.

Too much has been made in the past of the supposed inefficiency of batteries: as a matter of fact, 70 per cent. to 75 per cent. commercial efficiency can be maintained with care; and if this were not so, efficiency is the least important attribute of peak-load plant, and especially so in the case of a battery. In effect the battery is charged at power rates and discharged at lighting rates. If some of our large consumers on public supply mains only realised this, they would install batteries of their own, buy

current at power rates, and cheapen their own lighting supplies by arranging with the supply authorities for a "restricted-hour" supply, *i.e.*, they would take no current from the mains at peak-load time.

It does not matter how short a period of time during the day or the year a supply is demanded, there must be plant installed to meet it, and it has been found that for all duty of less than 8 per cent. daily load factor, *i.e.*, of less than two hours' demand during the 24 hours of the day, it most certainly pays to make storage battery provision. Beyond this point we must look to advantages other than direct saving in capital cost and running charges to justify the extension of the principle.

The author tenders his best thanks to Mr. S. L. Pearce, the City Electrical Engineer of Manchester, for facilities allowed and permission for the inclusion in this paper of data from official reports, and for the publication of facts and figures concerning the Manchester Corporation electricity works; also to Mr. E. A. Hilton for assistance in getting out the diagrams. The author would also like to make it quite plain that the opinions expressed in the paper are his own personal opinions.

Discussion at Manchester.

Mr. S. J. Watson said it was worth considering whether large batteries should be put in the generating station, or in connection with the distribution system. In connection with polyphase transmission schemes, the sub-stations where the A.C. supply was converted to D.C. would be the places in which to put the batteries. He thought the fairest system of rating a battery was on the basis of a two-hour rating, because the primary use of a battery was in connection with peak loads; the ordinary peak in the winter months lasted about 1½ hours, and a two-hour capacity would last through any peak that was likely to occur. The battery in Manchester had been installed at a cost of about £17 per KW. on the basis of a two-hour rating. On the score of cost the generating plant and the battery were almost identical. With the battery there were no standby losses; it was in this connection that the principal saving on a battery arose. Regarding the question of using boosters or regulating cells, the use of a regulating switch enabled one to deal promptly with any sudden emergency which required heavy discharges; if the battery were floating on the bars without the use of boosters, the pressure dropped when a heavy discharge occurred, and it would be almost impossible to switch the boosters in, whereas with regulating cells the operation was very simple. Wherever a large battery was in use it should undoubtedly be always kept on the bus-bars, so that in emergency there was the full capacity to rely on. He considered that a battery at its two-hour rating should have the capacity of the largest unit in the station. The efficiency of a battery really mattered very little, because the load which was supplied from it was only a percentage of the total.

Mr. Alderman Walker said the period allowed for repayment of loans on large turbo-generator sets was being reduced from 20 years to 17 years; the difference was to the good of the battery. With regard to the question of consumers having a battery on their own premises and having it charged at power rates, he thought the author perfectly justified in this idea.

Mr. E. C. McKinnon said one American company had individual contracts with the largest supply companies to maintain their batteries for 10 years, and during that period the battery might be discharged 150 to 200 times, but not more than 40 times during any one year. The loan period for a battery (seven years) was altogether unreasonable. The battery at the end of its life was still worth 25 per cent. of its original price as scrap metal. The commercial efficiency of the Manchester battery was rather low, indicating that the battery was overworked, and that possibly the charge was stinted. With a new battery it was possible to obtain a falsely high efficiency, but only at the expense of the plates. Maintenance should be based on the amount of work that the battery was called upon to do, and this was the system employed in the States.

Mr. P. P. Wheelwright said that in rushing up boiler plant a considerable amount of smoke was thrown out, which was very liable to cause trouble in the city, whereas if a battery were in use a greater time could be taken to bring up the boilers and so reduce this tendency. He had had three batteries before the one now in use, which was the only one that had ever done any honest work. The previous batteries had always to be nursed until the time when they were required, and when this time came the batteries would not work. When the present battery was installed, the makers told them to do their worst with it, and it would always work well. They had done this, and for the past four years the maintenance of this battery had been very low, and it had experienced the roughest time a battery ever had.

Mr. S. L. Pearce said he took it that, generally speaking, they agreed that the scheme was sound, and that the conclusions drawn by the author in his paper had been justified. There had been an undoubted saving in the cost of coal consumed, viz., £3,348. There was, in addition, a saving of £1,056 on capital as between the steam scheme and the battery scheme. This gave a total of £4,404. If, from this figure, the capital cost incidental to the battery itself were deducted, there was still a saving of £2,000, which, if it had been the only saving, would still have justified the scheme. The losses incurred in the battery and booster were more than covered by the coal saving. The total units lost were approximately 700,000, and the coal saving to cover those losses was more than four times greater. With present-day knowledge, the figures of capital for Stuart Street were possibly on the high side; they were drawn up at the end of 1907. Taking the battery on a two-hour rating, and reducing the estimates on the steam plant, there was practically no saving on capital. The question of switchgear gave rise to more anxiety than anything else in connection with the battery. It was decided that this switchgear should be treated as a high-tension board, and therefore, as the author had pointed out in his paper, the cubicle construction was adopted, and the isolation of all leads where possible. They had a system of remote-controlled circuit-breakers, which were fitted in the battery room alongside the battery. With regard to the loan periods, the L.G.B. seemed to be drawing the strings tighter and tighter. Seven years only was allowed for this storage battery, and to-day they only got 15 years for generating and sub-station plant; the term for boilers had also been reduced from 17 to 15 years.

Mr. C. L. E. Stewart, referring to Mr. Wheelwright's remarks, said that he also had a small battery which had a very rough time, and it was doing remarkably well. It ran on traction load, the efficiency was very good, and it was in very good condition after being in use for four years. It was working up to its full one-hour rating either way every two or three minutes. With regard to the record of overdischarge, the easiest way of judging it was for the switchboard attendant to watch the voltmeter chart. Records were well worth keeping.

Mr. E. Thomas said it was interesting to see that apparently it was not appreciated until comparatively recently that a battery had very great advantages from a cost point of view when considering large stations like Manchester. Seeing what the Americans gained by using very much larger batteries, it seemed that it might be advantageous for us to go further than we had already done.

Mr. W. Cramp said he noticed that the makers had signed a contract to maintain the battery at its rated capacity for 15 years. In dealing with batteries he had found that makers objected to maintain a battery at its rated capacity throughout the maintenance period, but they would guarantee 85-90 per cent. of its rated capacity at the end of the maintenance period. The load factor improvement was estimated to save £10,166, whereas the estimated saving from standby value, and in cost of generation, was given as £5,821. Was the difference between these two figures due to the "buffering" effect?

Mr. F. H. Whysall, in reply, said that in the case of a large D.C. system the advantage was in favour of putting a large battery down at the generating station. In the case of a three-phase system with sub-stations, the best place was the sub-station. He considered that a one-hour rating to carry over the peak was sufficient. The stand-by boilers were not under steam at all. With regard to the difficulty in all paralleling boosters under breakdown conditions, there was a large margin, and, failing this, arrangements were made whereby the battery could be put on load without boosters. Integrating wattmeters were fitted to register the input and output of the battery, but they were only used to indicate the state of the charge. A recording voltmeter was also in use as recommended by another speaker for the same purpose. A quicker method of estimating the residue was wanted than running a planimeter over the chart; the pilot cell reading gave the information at once. The author believed that the oftener a battery was charged and discharged, the better it was for the battery, provided the operations were carried out with due care. The proposal that the maintenance charges should be based on the number of charges and discharges in a given time was another innovation, and he did not think that would be suitable for the requirements of his station. Mr. Pearce had shown that even putting the problem at its lower level, they could expect £2,000 saving. He was perhaps too optimistic in crediting all the saving shown to the battery; the circumstances at Dickinson Street were peculiarly favourable to a battery. The cutting down of loan periods by the L.G.B. influenced the figures shown in favour of the battery.

Discussion in London.

Mr. J. S. Highfield, in opening the discussion, referred to the importance of the battery, in view of the security it gave to other sources of supply. It relieved other plant and mains, and represented a saving in capital; in most cases a good case could be made out for it. The use of a battery on peak loads was rather opposed to the stand-by idea, and a compromise was necessary; but even then it was worth adopting. The best method of control was to use a hand-controlled booster for charging and discharging, with a short-circuiting switch to save the booster from destruction. Booster construction was a matter of careful design, as the machines had to stand large overloads. He agreed with the author's figures for efficiency; he always took 74 per cent. himself. He thought that a better system of charging users for maintenance could be introduced, as the present method penalised the careful user.

Mr. E. C. McKinnon suggested that people would be too optimistic after reading the paper; it should not be thought that the author's efficiencies could be repeated everywhere. Engineers were realising the usefulness of the battery, and adopting it for this reason.

Mr. A. M. Taylor said he disagreed with the figures taken for interest and sinking fund, since in the case of a large station like Manchester it should not be necessary at all to go to the Local Government Board for a loan on behalf of the battery, but the same might be paid for out of surplus profit; then, again, as regards maintenance, he was satisfied that it was distinctly cheaper for the Corporation to maintain the battery itself, provided that it was not going to be worked too heavily. He fully agreed with a saving of £4 4s. per day for the five summer months on account of the boilers which had not to be kept under steam on the chance of a storm-cloud, but he was not quite sure whether an additional £4 4s. credited on account of the regular peak available from the battery should be added to the above £4 4s. Supposing, however, that this was not included, the saving on the first heading was only reduced by £460, and as regards the other

sum of £630, he (Mr. Taylor) quite agreed with this. So that in any case under the most unfavourable estimate he had £460 + £630 = £1,090, with a possible figure of £1,554. As regards the next stage in the coal bill, the cost per unit turned out by the steam plant during the peak load was 1·55d., and the cost of each unit put into the battery at night time (to be used for the peak on the day following) was only 0·237d., the saving therefore being 1·31d. on every unit turned out during the peak. Taking the number of units turned out during the peak as 1,560,000, the author obtained the tremendous annual saving of £8,534. (Mr. Taylor ventured to think, however, that the author had made a slip as to the number of units, which would appear to be those taken for two years instead of one year.) The saving was really prodigious, because adding to the sum of £8,500 (the author's figure) the additional sum of £1 090, there was a total of over £9,500, saved in coal alone. This sum capitalised at 5 per cent. was equivalent to an investment of £180,000. In the present case, the capital cost was approximately £22,000, and the interest, sinking fund, and maintenance of this investment would be of the order of £3,800, whereas the coal saving *alone* is shown to be at least £9,000, *in addition to which* there should be added the saving on the capital cost of generating plant, representing £1,000 per annum, and a saving in the wages at the generating station representing another £1,500 per annum, besides increased efficiency of generation during the day. The value of the battery as a standby could not be overrated. On a three-minute rating it could be taken as £2 10s. per kilowatt, and the floor space on the same rating at one-twentieth of a square yard per kilowatt. Some engineers had recently expressed the opinion that storage batteries would be of very little use in the future on account of the large development of the alternating-current load. From the figures given it was clear that the battery would well bear the handicap of the additional cost of the inverted rotary, and still show a very large margin of saving. This applied more to the case of a large A.C. system, where numerous rotary converter sub-stations were employed for supplying direct current into the feeder networks. In such a case, a failure of the A.C. supply caused a tremendous overload upon any D.C. generating plant on the system. As regards the question of the employment of boosters, as against regulating cells, Mr. Taylor believed that it would be found that boosters provided with automatic short-circuiting switches, would permit of rapid discharge rates being regularly employed, and of any emergency discharge rate being taken care of with safety. It must be borne in mind, in comparing boosters with regulating cells, that in any case a booster had to be provided for the charging of the battery, so that one had to balance the cost of boosters, on the one hand, as against that of boosters plus regulating cells on the other, with the additional disadvantage that some parts of the battery were discharged at different rates to others, and the heavier the discharge rate employed, the worse this disparity became, with consequent additional trouble in maintenance.

Mr. E. S. Jacob disagreed with the method of comparing capital charges on batteries and steam plant; in the case of the former these charges would be reduced to nothing after ten years, and this was equivalent to a double saving after that in comparison with steam plant, the cost of which was spread over 21 years. Then the battery had a scrap value of 25 to 30 per cent. of its original value, while steam plant had practically none. In regard to maintenance contracts, everybody said they used their battery well, and all would ask for low rates.

Mr. W. Fennell said a small battery was as large proportionally in a small plant as a large one on a big system. The short loan periods allowed by the L.G.B., and having to write off the capital cost in seven years, often killed a battery scheme; the makers would contract for the maintenance of the full battery output for ten years. It was difficult to understand the home preference for boosters as against automatic regulating switches. In his own station they had been running all their gas engines on full load, owing to shortage of plant, and on one or two occasions when a set came off suddenly the automatic switch in connection with the battery operated so smoothly that the consumers were unaware of the occurrence.

Mr. P. V. McMahon showed some curves of a battery sub-station on the City and South London Railway, in which the batteries took 50 per cent. of the sub-station load.

Mr. Roger T. Smith said the author referred to batteries with steady charge and discharge over periods of hours; it might be of interest to refer to their use on traction loads where rapid charge and discharge occurred over periods of minutes. The Great Western Railway supply from Park Royal station was to two sub-stations, each with a battery in parallel with motor-converters. At the time of heavy load (6 p.m.), the maximum load at the power station with the battery in use was 2,720 KW., and without it, 3,870 KW., three generating sets being in use in the former case and five in the latter. The improvement in the daily load factor on the steam plant, comparable with the author's figures, was some 17 per cent., but it depended on the amount of the total load going through the battery, which should be 15 or 20 per cent. The variation in the traction load was 300-3,000 KW., and the lighting load variation was very much less. The batteries allowed of a machine load factor of 85 per cent., and during periods of heaviest load of 95 per cent., being obtained; although the traction load varied 1,000 per cent., there was no difficulty in keeping a plus or minus 4 per cent. variation on the lighting bus-bars. The battery had for six years been considered a stand-by to the A.C. side, as suggested by Mr. Taylor. It would need 66 per cent. more steam plant if the batteries were dispensed with, and entail a greatly increased steam consumption.

Mr. C. P. Sparks thought it was a difficulty that batteries were so soon outgrown with increasing loads. The railway sub-station referred to by Mr. McMahon took a steady load of 400 KW., although 800-1,000 KW. loads were dealt with; the plant load factor was about 95 per cent.

Mr. A. Hutt referred to the heavy current battery regulating switch, and showed views of typical switches in use on the Continent. One of these having 29 contacts, was motor-operated and designed for a normal current density of 500 amperes per sq. in. on the brushes, with large overload capacity. Such switchgear could be automatically controlled from a distance. (Mr. A. M. Taylor, interposing, said Continental makers appeared to be reluctant to supply such switches for really large currents; in Birmingham they were offered a switch for 6,000 amperes instead of 17,000 amperes, but a booster could be short-circuited with impunity.)

Mr. Whysall, replying, said the battery at Manchester was partly regarded as an emergency battery, and they found usually that when it was most fully discharged the load was falling rapidly. The excellent results shown during the first year were obtained when the battery was quite new. During a sudden storm the battery held the load until the steam plant was got running, and in this way its usefulness was much more than its size indicated. The 10-year period was to the disadvantage of the battery; its life was much longer than that, and the Manchester maintenance contract was for a period of 15 years. In his opinion, an emergency battery should have a regulating switch, but a peak-load battery should have a booster combination. As regards Mr. Sparks's remarks the battery should be extended as the load grew.

Physical Society.

At the meeting on January 24th, 1912, a paper, entitled "The Resistance of Electrolytes," by Messrs. S. W. J. Smith and H. Moss, was read by the former.

Some experiments upon this question were exhibited before the Society in 1911. In these a modification of Wien's method was used—the optical telephone being replaced by a vibration galvanometer—and the conclusion was drawn from them that the resistance of an electrolyte varies to an easily perceptible degree with the frequency of the alternating currents to which it is subjected. It is, however, unsound to use the method unless it is shown that the effects of leakage through the electrolytic condensers can be neglected or allowed for.

The authors have used a method which depends upon simultaneous measurement of the voltage between the ends of a tube containing the electrolyte and of the current passing through it. The former was measured by means of an Ayrton-Mather electrostatic voltmeter connected to auxiliary electrodes, and the latter by means of a Duddell thermo-galvanometer.

In the cases examined it was found that the resistivity of the electrolyte was constant within 0·05 per cent., whether steady currents or currents of any frequency up to 2,300 alternations per second were used.

A paper on "The Electrical Conductivity and Fluidity of Strong Solutions" was read by Mr. W. S. Tucker.

The author carried out a series of experiments to determine if there were any definite relation between conductivity and fluidity in the case of calcium chloride solutions. The feature of these determinations was the simultaneous observation of viscosity, electrolytic resistance and temperature.

The results obtained suggest that no reliance can be placed on ionisation data derived from electrical conductivity observations.

Institution of Electrical Engineers.

Annual Dinner.

On Thursday, last week, the annual dinner and reunion of the Institution was held at the Hotel Cecil; the president, Mr. W. Duddell, F.R.S., occupied the chair, and the company included nearly 400 members and guests. Unfortunately, a number of the latter, including Vice-Admiral Prince Louis of Battenberg and Sir Alfred Keogh, were prevented from attending.

After the loyal toasts, Mr. Hebbert Samuel, M.P., the Postmaster-General, proposed "The Institution of Electrical Engineers," claiming that he was at the head of probably the largest electrical enterprise in this country. The Post Office, he said, owed much to electrical engineers, and was grateful for the assistance rendered to the development of electrical science by the Institution; the Post Office, however, possessed a highly qualified staff of its own, which had developed many ingenious devices, and occasionally accomplished the remarkable feat of transmitting two conversations simultaneously over one telephone wire. His department was indebted also to the Institution for the loan of its stately building on the Embankment for the Conference on Wireless Telegraphy last year, which had made a deep impression on the delegates.

The electrical engineers had built up a great and growing industry; it was stated recently in the House of Commons, in answer to a question, that in 1903 our exports of electrical machinery were valued at £437,000, while those of the United States were worth £1,064,000; in 1911, our exports had increased to £1,791,000, and those of the United States to £1,739,000, showing that we had made remarkable progress. If capital represented the pocket and labour the hand, the professional men were the brains of the electrical industry. When recently the Government were engaged in the difficult task of forming a technical Committee to inquire into the merits of the various systems of wireless telegraphy, the first name that occurred to them was that of the President, Mr. Duddell, whose colleagues included two ex-presidents

of the Institution, and one ex-president of the two sister bodies. Mr. Duddell was himself the inventor of the "singing arc,' which formed the basis of one of the systems, but so great was their confidence in his impartiality that their only fear was lest, through excess of conscientiousness, he should be biased against that system.

Mr. Duddell, in responding, reminded his hearers that when the Institution was founded in 1871, the only important application of electricity was that of telegraphy. Since that date, electricity had invaded the domain of all the sister sciences, and had become intimately interwoven with our daily life and every department of industry; it was involved in the vital processes of our bodies, and it was now thought that even "mass" was only a manifestation of electricity in motion. That day their membership was 7,300, a development of one hundredfold in 41 years, and that was not the limit. In 1907 there were half a million people employed in the electrical industries in this country, or 14 per cent. of the whole number engaged in engineering. When the results of the new census were published next year, he believed a great increase in these figures would be recorded.

Prof. John Perry proposed the health of "The Guests," alluding to the tremendous amount of practical intellect and successful achievement which they represented. He would like the guests to know that the scientific engineer always talked shop and thought shop—he had other interests, but that was his predominating interest. The study of history was important as a guide to the future, but now they had applied science which must be taken into account as an important factor in making history. He urged the guests to encourage a scientific spirit in their subordinates and to oppose the inertia which existed in all Government departments. Remarking that no sign of electrical knowledge in olden times had been discovered by the archaeologists, Dr. Perry said it was certain that our ancient forerunners had no big engines—if they had had any, they would not have left us an ounce of coal.

Sir H. B. Buckley, Lord Justice of Appeal, in responding, briefly commented on the vast developments of electrical science in connection with commerce, agriculture, and other industries. Within the last 50 years, he said, the spread of knowledge had been prodigious; and in that branch of knowledge which was concerned with industry, no study had had more influence on the development of human society than the study of electricity. Probably it would be found that at the root of all things lay one simple law which gave rise to all the various phenomena of Nature—perhaps the law of vibration. They knew how to catch electricity and how to use it, but who knew what it really was?

The President invited the representatives of foreign institutions to address the company, and M. Grosselin, President of the Société Internationale des Electriciens and of the Société des Ingénieurs Civils de France (6th Section), said that in the past the French presidents had rarely been able to accept the invitations of their English *confrères;* in France it was not customary for societies to give annual dinners, so that the French presidents could not return the hospitality offered them. It would be of great benefit if they could hold together a meeting of English and French engineers to exchange ideas; this year the Société Internationale hoped to hold such a conference in Paris in May, for which a programme of visits to works, &c., would be arranged, and he hoped that many of the members of the Institution would be able to be present—they would be heartily welcome.

Herr Geheimrat Christiani, President of the Verband Deutscher Elektrotechniker, and past president of the Elektrotechnischer Verein, Berlin, conveyed the best wishes of those societies for the development and prosperity of the Institution. He referred to the visit of Dr. Kapp to Germany, when he presented a portrait of Faraday to Dr. Budde, President of the International Electrotechnical Commission, and expressed the gratitude and good wishes of Dr. Budde to the Institution. He concluded by remarking that the Verband was about to enter into similar close relations with the Austrian and Swiss Societies, and that such international relationships could not be too highly valued; he hoped their friendship would prove lasting.

The company then adjourned to another room, where friends foregathered and conversation was maintained up to a late hour.

Music was provided during the evening by the "Imperial Orchestra." The programme was closely adhered to, the speeches being comparatively few and brief, and thus there was ample time for the reunion, one of the principal social events of the Institution's year, and one which is highly appreciated by the members.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

"Chain-Pull" Switch Lampholders.

The General Electric Co., Ltd., have brought out a "chain-pull," switch lampholder with a movement which is extremely gentle and reliable. The construction of the lampholder differs considerably from that of any other on the market. Ease of pull is secured by means of a spring ratchet movement. A steatite holder is provided for the chain, which is detachable, and permits longer or shorter lengths to be used as required. The movement is surrounded by a protecting porcelain wall. Barrel terminals are provided, which facilitate wiring. The plungers are particularly massive. These holders are supplied in a variety of styles, and are very inexpensive.

The British Thomson-Houston Co., Ltd., of Mazda House, Upper Thames Street, E.C., are also supplying a chain-pull holder of similar design.

Adjustable Eccentric.

The accompanying illustration, fig. 1, shows an adjustable eccentric, which Mr. John Jardine, of Nottingham, is now offering. The eccentric has been used in connection with the various classes of machinery made by Jardine's for over 20 years, but hitherto has never been offered as a separate item by them.

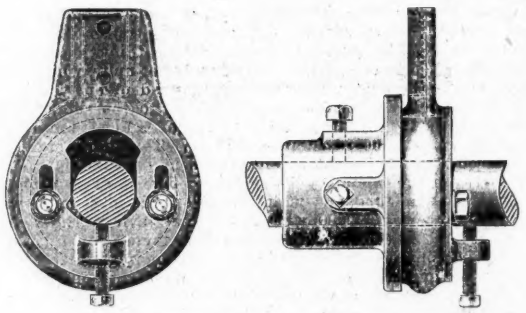


Fig. 1.—Jardine Adjustable Eccentric.

Through several inquiries and orders for it, they have now decided to place it on the market. Any throw can be obtained from zero to the maximum, and can be adjusted to a nicety by the set-screw. It will be seen that the eccentric is a useful piece of mechanism, and is suitable for a variety of applications.

Fixing Contacts in Springs.

Fig. 2 shows a simple, but effective, device invented by Mr. S. E. Sbawley, of 67, Ronald Street, Old Swan, Liverpool, for cutting off contacts for springs and simultaneously inserting them in the latter. The little bits of wire are easily lost, and are difficult to handle, causing loss of time; by this method, however, waste of material and time is avoided, and a considerable saving of cost is effected, which is not to be lightly regarded, in view of the immense numbers of spring contacts that are called for nowadays. In the figure A is the punch holder, B a steel cutting-off plate, C a steel guide plate, D a steel die, E a pin for the wire to rest on with spring O, F a steel ram, which is pressed against the plate H by the rod G to

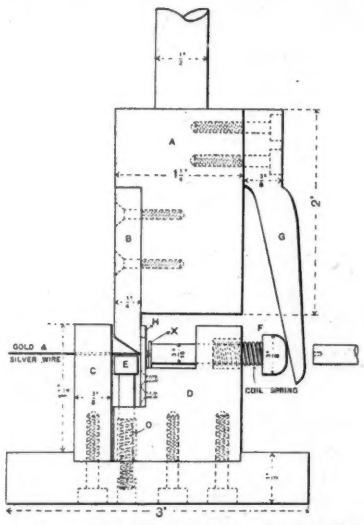


Fig. 2.—Device for Fixing Contacts in Springs.

tighten the wire in the spring X, with the aid of the bush shown, which makes a ring in the spring round the wire. If a double-headed contact is required, a hole is made in the ram F, as indicated in the inset. The wire is put through C and H, the spring is placed on the wire, and the press is then pulled down, when F pushes the wire into position, B cuts it off, and at the same time the wire is fixed in the spring. The advantages of this method, compared with that of cutting the wire into little bits, picking up those that are not lost with tweezers and putting them in a die, and then riveting the wire in place with a hammer, are obvious.

Westminster Electric Cookers.

We illustrate in fig. 3 the No. 3 electric cooker of the Westminster Tool and Electric Co., Suffolk House, Laurence Pountney Hill, London, E.C. It comprises a complete equipment for a family of eight persons, consisting of three boiling plates, grill, oven and hot cupboard. The overall dimensions are 25 in. width × 21 in. length × 36 in. height, the oven measurements (internal) being 14 in. width × 13 in. length × 21 in. height. The design of this cooker is understood to embody the results of a large experience. The sides and back of the cooker are porcelain-

enamelled—looking like tiling. The oven is enamelled inside and thoroughly lagged. The top plate is of polished steel, fitted with two 8-in. diameter and one 6-in. diameter boiling plates, each with three heats. The grill is 12 in. × 8 in. The hot cupboard on the top of the oven is fitted with a drop-down door, forming a shelf. The oven door is fitted with a ventilator and a glass panel, enabling

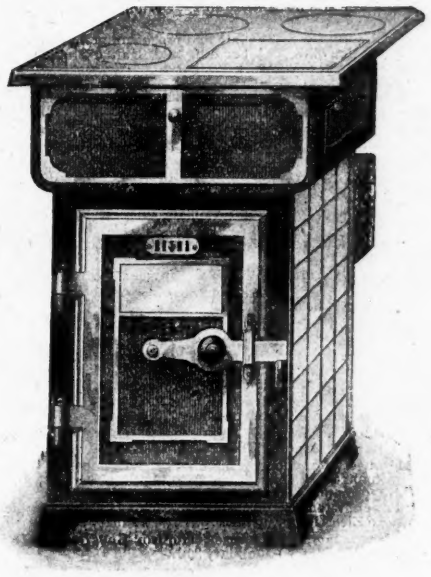


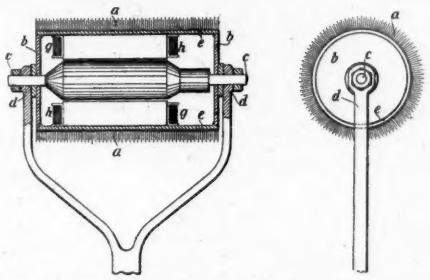
Fig. 3.—No. 3 Westminster Electric Cooker.

the contents of the oven to be examined without opening the door. All connections are brought to a connection box at the back of the cooker.

The power consumption is stated as follows:—Oven, 2,200 watts; 8-in. diameter boiling plates, 1,200 watts; 6-in. diameter boiling plates, 800 watts; grill, 1,100 watts; all with three regulations.

Electrical Window-Cleaner.

Mr. O. E. Fox-Adams, of 125, Constantine Road, Hampstead, has devised and patented a rotary brush for cleaning windows, which should be of considerable use for shops, warehouses, hotels, railway trains, &c. It resembles the electric hair-brush, in that it consists of a cylindrical brush or swab, driven by an internal electric motor, the armature shaft being held in a fork, while the field magnet system rotates, carrying with it the brush. A diagrammatic section



a, brush; *b*, closing disk; *c*, spindle; *d*, bearings; *e*, casing; *g*, *h*, magnet coils.

Fig. 4.—Electrical Window-Cleaner.

and end view are given in fig. 4. The inventor's chief difficulty was to find a motor combining sufficient strength with the necessary lightness; having accomplished this, and adopted aluminium as far as possible in the construction of the framing, &c., to reduce the weight to the minimum, he has succeeded in producing a tool with which windows and similar surfaces can be quickly polished with the least expenditure of labour.

Electrical Treatment at Bradford Hospital.—At the last quarterly meeting of the Bradford Hospital Fund (Incorporated), held on Thursday at the Infirmary, it was reported that the work of the electrical department was on the increase. In 1,243 cases electrical methods had been used to locate various fractures of limbs and other ailments of patients who came to the infirmary. Dr. Mitchell had charge of the electrical department, and he had attended to 3,582 cases during the past year.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

ST. VINCENT.—In connection with the recent Canadian-West Indies reciprocity arrangements, the Government of St. Vincent have drafted a new tariff differentiating between goods from foreign countries and goods from the United Kingdom, Canada and Newfoundland, and giving preferential rates of duty to the latter. This new tariff is to come into force at a date which will subsequently be notified; meanwhile the following information will be of interest to our readers:—

	Preferential rates.	*General rates.*
Lamps	10 % ad val.	12½ % ad val.
Electric machinery and electric dental appliances of all kinds not specifically exempted from duty ...	10 % ad val.	12½ % ad val.
Wire	10 % ad val.	12½ % ad val.

The following goods are to be admitted free of duty, irrespective of their origin:—Machinery, and any parts or fittings thereof not imported for sale, which the Governor in Council may consider to be likely to further the introduction of any new industry or the improvement of any existing industry; medical and surgical instruments, appliances and apparatus imported by any duly qualified medical practitioner for his own use in the exercise of his profession; telegraph wire, telegraphic, telephonic and electrical apparatus and appliances of all kinds for communication or illumination, including all material for the use of the West India and Panama Telegraph Co., and any telegraph company (wireless or otherwise) recognised by the Government.

BRAZIL.—The new Consular invoice regulations for goods shipped to Brazil laid down in the Budget for 1912, have been repealed.

ST. LUCIA.—A new ordinance passed by the Government of St. Lucia provides that no person shall establish any wireless telegraph station or install or work any apparatus for wireless telegraphy in any place or on board any ship registered in the Colony, except under, and in accordance with, a licence granted for that purpose by the Governor. Also no person shall work any apparatus for wireless telegraphy installed on any merchant ship whether British or foreign, while that ship is in the territorial waters of the Colony, otherwise than in accordance with prescribed regulations.

INTERNATIONAL ELECTROTECHNICAL COMMISSION.

Considerable practical progress has resulted from the meetings of the Special Committees of the I.E.C. held in the Town Hall, Zürich, from January 13th to the 19th.

The meetings, to which about 12 nations were invited to send special delegates, were presided over by Dr. W. Wyssling (Symbols), M. E. Huber-Stockar (Rating), and Dr. H. Zoelly (Prime Movers), three Swiss being chosen, as the Commission adopts the plan of choosing, as the president of the Committee, one of the members of the National Committee of the country in which the meetings happen to be held. Symbols were first dealt with, and a long discussion took place as to the relative importance of distinguishing between vector and scalar quantities and between electric and magnetic quantities. The Germans urged very strongly that the whole of the script alphabet should not be taken up for the sake of a very few magnetic quantities; if these were made to differ, in the actual symbol, from the corresponding electric quantities the script characters would be set free for vectors which they say will, to an increasing extent, be employed for the practical solution of alternating-current problems. The majority of the delegates, and especially the French were, however, against the German proposal, being of opinion that, from the point of view of electrotechnics alone, it was imperative to be able to distinguish between electric and magnetic quantities. It may be that this subject has not received as much consideration in the National Committees as it merits. With a few additions and notable modifications, such as Maxwell's D for electrostatic flux-density instead of B, the Paris proposals of last May were agreed to. Should, therefore, the proposals of the Pan-German Society, the A.E.F. (Ausschuss für Einheiten und Formelgrössen) find favour ultimately, generally speaking, the symbols proposed would not be confused, as the letters would not be identical for electric and magnetic quantities.

The rating question occupied three whole days of strenuous but most amicable discussion. The British views were ably put forward by Dr. Gisbert Kapp and Dr. R. T. Glazebrook, C.B., the latter especially interesting himself in the proposal for an international standard for copper, the exact form of which is to be decided, in consultation, by the four National Laboratories of America, France, Germany and Great Britain; the result will form a special publication of the I.E.C. Dr. Kapp was much assisted by Mr. A. R. Everest, the official representative of the B.E.A.M.A., and the co-operation of the British manufacturers was duly appreciated.

Modifications and new proposals had been received from several National Committees, and, although occupying much time, their consideration has rendered the present proposals more complete, and much more likely of acceptance by the industry, as a whole, than were the Paris proposals of March last; it should not, however, be forgotten that at Paris nothing concrete was before the Committee.

Several interesting proposals have been made which differ from the rules as at present adopted by different countries, but seeing that the delegates are also members of the local Committees responsible for the national rules, there is every liklihood of the I.E.C. proposals, finding their way gradually into the local rules. For instance, the basis of rating is to be the ultimate temperature, and not the temperature rise, the former being the damaging factor; the "cooling air" is to be recommended instead of the "surrounding air," as, under modern methods, what really has to be taken into account is the air going into the machine, which is not necessarily the surrounding air. Then the maker is not to be held responsible for the proper working of a machine if it is made to carry a continuous overload, so that if a man orders a 1,000-KW. machine, he must not expect it to carry 1,500 KW., without paying for it; of course, momentary peaks, as they do not materially affect the temperature, are not included under overloads. A basis of comparison of various tenders is also proposed on the principle of an extra 10° C. permissible temperature.

Detailed reports will be issued by the central office of the I.E.C. without delay, and it should be noted that the proposals of these Committees are to be submitted for the consideration of the various National Committees with a view to ratification at the next plenary meeting of the Commission, to be held in Berlin from September 2nd to 6th this year.

The Italian Society of Electricians has decided to adopt the recommendations of the I.E.C., as and when promulgated and to recommend their employment in all international specifications for electrical machinery, and to suggest that when the necessity arises in international contracts for an arbitrator, he shall be chosen by the president for the time being of the I.E.C.

The general arrangements for the comfort and entertainment of the 25 delegates were admirably attended to by the Swiss Committee and the Swiss Society of Electricians, the president of which, Prof. Jean Landry, came from Lausanne to preside at the official banquet.

The wisdom of the Turin meeting in appointing these small international committees to discuss actual details and formulate definite proposals has amply justified itself. The work of the Zürich meetings will undoubtedly be of real practical value to the industry, for when finally adopted at Berlin it will form the basis of international specifications for machinery to be used in all foreign trade.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

2,125. "Electric lighting." M. S. OKUN. (Convention date, January 26th, 1912, United States.) January 27th. (Complete.)

2,128. "Electrically-controlled gas valves." A. ST. J. COOKE. January 27th.

2,136. "Control of electric motors for driving screw propellers." SIEMENS SCHUCKERTWERKE G.M.B.H. (Convention date, January 27th, 1912, Germany.) January 27th. (Complete.)

2,139. "Combined automatic locking device and detachable lamp-cap for locking bayonet type electric lamps and the like, to their holders." H. T. WORRALL. January 27th. (Complete.)

2,146. "Terminal connections for aluminium and similar conductors." L. W. CHUBB. (Convention date, February 16th, 1912, United States.) January 27th. (Complete.)

2,152. "Devices for electrocuting animals." H. SMITH. (Convention date, February 3rd, 1912, United States.) January 27th. (Complete.)

2,165. "Methods and apparatus for producing elongated electric arcs." F. H. A. WIELGOLASKI. January 27th. (Complete.)

2,170. "Electromagnet typewriters." J. SCHNYDER. (Convention date, January 29th, 1912, Germany.) January 27th. (Complete.)

2,184. "Receiver for submarine signalling." SIGNAL GES. m.b.H. (Convention date, November 30th, 1912, Germany.) January 27th. (Complete.)

2,185. "Receiver for submarine signalling." SIGNAL GES. m.b.H. Convention date, December 18th, 1912, Germany.) January 27th. (Complete.)

2,198. "Devices for closing and disinfecting telephone mouthpieces and other articles." M. DICKINSON. January 27th.

2,199. "Apparatus for electrocuting animals." H. SMITH. (Convention date, February 17th, 1912, United States.) January 27th. (Complete.)

2,214. "Method and apparatus for the production of elongated electric arcs for the treatment of gases." F. H. A. WIELGOLASKI. January 27th. (Complete.)

2,215. "Disinfecting apparatus for telephones and the like." L. BLOCK. (Convention date, March 13th, 1912, United States.) January 27th. Complete.)

2,233. "Remote-controlled electrical circuit-breaker." S. WHIPP, C. W. D. BOURNE and F. WHIPP. January 28th.

2,238. "Electrical condensers of the variable type." A. E. WATKINS. January 28th.

2,247. "Metal-sheathed insulated electric conductors." F. J. RIDDALL and H. S. FURNEAUX. January 28th.

2,261. "Electric thermal control for use in connection with electrical heating, cooking and ventilating apparatus." J. MCKAY and J. DOREY. January 28th.

2,269. "Electrodes for electric accumulators." H. F. JOEL, Sen. (Divided application on 24,443, October 25th, 1912.) January 28th.

2,295. "Commutators for controlling electrically operated mechanism." A. BRUNN. (Convention date, April 9th, 1912, Germany.) January 28th. (Complete.)

2,302. "Selecting devices for telephone systems." A. KATZ. (Convention date, January 29th, 1912, Germany.) January 28th. (Complete.)

2,332. "Electric sounding recorder." P. G. SHOWELL and W. G. BENNETT. January 29th.

2,356. "Electric lampholder." J. S. HOLMES. January 29th.

2,363. "Electric-driven vacuum-cleaning apparatus." W. W. R. F. GRIFFITHS and WIZARD DUST EXTRACTOR CO., LTD. January 29th.

2,372. "Electric safety lamps for mines." T. ATTWATER. January 29th.

2,395. "Process of making alkaline gelatinous electrolyte." G. S. ENGLE. (Convention date, October 8th, 1912, United States.) January 29th. (Complete.)

2,396. "Double copper oxide plate and process of producing same." G. S. ENGLE. (Convention date, October 8th, 1912, United States.) January 29th. (Complete.)

2,397. "Telephone systems." W. J. RICKETS. (Addition to 4,282 of 1911.) January 29th. (Complete.)

2,402. "Electric batteries." C. D. GALLOWAY, JUN. (Convention date, February 1st, 1912, United States.) January 29th. (Complete.)

2,409. "Selecting devices for telephone and other systems." SIEMENS BROS. AND CO, LTD. (Siemens & Halske Akt.-Ges., Germany.) January 29th.

2,418. "Electric controllers." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 29th.

2,423. "Means for connecting an electric cable to the detonator wires of mining cartridges." N. FIELD. January 29th.

2,424. "Method and means of connecting electric conductors to terminals." N. FIELD. January 29th.

2,445. "Electro-thermostats." W. R. RIDINGS. January 30th.

2,453. "Electric lighting sets for motor-cars, motor-boats and air craft." F. HALL. January 30th.

2,469. "Storage battery charging." L. J. SIMON, A. F. ROBERTS and E. H. CHADWICK." January 30th.

2,471. "Arrangement for the static transformation of three-phase alternating current into one-phase alternating current having the treble frequency of the primary current." F. SPINELLI. January 30th. (Complete.)

2,499. "Life-saving appliances for electrically and mechanically-operated vehicles." C. R. HEISER. January 30th.

2,507. "Welded receiver." V. ANDERSON. (Convention date, April 3rd, 1912, United States.) January 30th. (Complete.)

2,508. "Method of reducing telephonic disturbances." O. B. BLACKWELL and G. A. ANDEREGG. (Convention date, April 11th, 1912, United States.) January 30th. (Complete.)

2,509. "Power system for automatic switches." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) January 30th. (Complete.)

2,514. "Electric lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 30th.

2,539. "Positive plates for electric accumulators and means for insulating such plates and other electrical accumulator plates from their cells." H. H. DADSON. January 31st.

2,577. "Electric furnace with electrodes running through the receptacle for the charge, and means in the upper part for carrying off the gases." A. HELFENSTEIN. (Convention date, February 4th, 1912, Austria.) January 31st. (Complete.)

2,588. "Gas controllers, electric time switches, and the like." G. O. H. HORSTMANN, E. H. HORSTMANN, A. HORSTMANN and W. T. EDGAR. January 31st.

2 610. "Telephone systems." E. A. GRAHAM and W. J. RICKETS. January 31st. (Complete.)

2.612. "Selective signalling system." R. N. HILL. (Convention date, March 21st, 1912, United States.) January 31st. (Complete.)

2,636. "Means for interlocking electric switchgear with lids of boxes." H. HIRST and J. STRACHAN. February 1st.

2,683. "Collectors for electric currents." C. C. WILSON and BROWN-MACKENZIE SIGNAL CO., LTD. February 1st.

2,698. "Primary electric batteries." A. P. MANCHESTER and H. M. SPOONER. February 1st. (Complete.)

2,697. "Electric transformers." C. ASH & SONS & Co., LTD., A. B. JONES and W. G. LEE. February 1st. (Complete.)

2,700. "Control system for automatic switches." TELEPHON APPARAT FABRIK E. ZWIETUSCH & Co. G.m.b.H. (Convention date, March 15th, 1912, Germany.) February 1st. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

ENUMERATION OF TELEPHONE CALLS. S. D. Williams. 28,007. December 13th.

1912.

ELECTRICAL ATTACHMENT FOR MOTION PICTURE MACHINES. G. E. Ward. 18,072. August 6th.

HAND-REGULATED ELECTRIC ARC LAMPS OR PROJECTORS. R. Rigby. 19,099. August 20th.

CONNECTION APPARATUS FOR ELECTRIC CIRCUIT CONDUCTORS. T. E. Murray. 19,535. August 26th. (February 9th, 1912.)

ELECTRIC LOCOMOTIVES, MOTOR-BOATS AND THE LIKE. Maschinenfabrik Oerlikon. 19,890. August 31st. (September 23rd, 1911.)

SEATS OR HOLDERS FOR CONNECTING CORD PLUGS FOR TELEPHONE EXCHANGES AND SIMILAR APPARATUS. Siemens Bros. & Co., Ltd., and E. A. Petithory. 21,946. September 26th.

ARRANGEMENTS FOR OBTAINING SPARKLESS COMMUTATION IN ROTARY CONVERTERS COUPLED TO ALTERNATING-CURRENT BOOSTERS. Siemens Schuckertwerke Ges. 23,285. October 11th. (November 14th, 1911.)

CONNECTORS FOR ELECTRIC CONDUCTORS. British Thomson-Houston Co. (General Electric Co.) 25,775. November 9th.

DIFFERENTIAL ARC LAMP WITH INCLINED CONVERGING ELECTRODES. Korting and Mathieson Akt.-Ges. 26,318. November 16th. (December 22nd, 1911.)

SOLENOID COIL FOR ALTERNATING-CURRENT ARC LAMPS. Korting & Mathieson Akt.-Ges. 27,024. November 25th. (December 3rd, 1911.)

ELECTRIC STORAGE BATTERIES. J. T. Niblett. 819. January 10th.

SIGNALLING LAMPS. H. J. Jowett. 932. January 12th.

VAPOUR ELECTRIC LAMPS. F. Bousson and Guesnier. 991. January 12th.

ELECTRIC BATTERY LAMPS. A. Hunte and H. Hunte. 1,013. January 13th.

HOLDERS FOR ELECTRIC LAMPS. A. R. Muller. 1,166. January 15th.

ELECTRIC IMITATION CANDLE LAMPS. E. J. Wilson and Candolite Co. 1,178. January 15th. (Cognate application, No. 1,179 of 1912.)